

RAY JEFFERSON LIMITED WARRANTY

This unit is fully covered by our limited warranty. It will give you dependable service and long life under normal conditions encountered in marine use. The limited warranty is as follows: This warranty applies to the original purchaser only.

Components: Ray Jefferson® warrants every component of the equipment, with the exception of transistors, tubes and glass bulbs to be free from any defects caused by poor workmanship or faulty materials. Under the warranty, Ray Jefferson® is liable only to the repair, or, at Ray Jefferson® option, the replacement, without charge, of any component found to be defective under normal use within 1 year of the date of Ray Jefferson® shipment, if the following conditions are met:

- (1) Ray Jefferson® must be promptly notified, in writing, upon discovery of any such defects;
- (2) The defective components must be returned to Ray Jefferson®.
- (3) Ray Jefferson® examination must disclose to its satisfaction that defects have not been caused by abuse.
- (4) Customer must pay shipping costs both ways.
- (5) Water damage will void warranty.

Warranty is void unless registration card is returned to the factory within 10 days after purchase. This warranty does not apply to any of our products which have been repaired or altered by unauthorized persons or service stations in any way so as, in our judgment to affect their stability or reliability, or which have been subjected to misuse, negligence, or accident, or which have had the serial number altered, effaced, or removed. Neither does this warranty apply to any of our products which have been connected, installed, or adjusted otherwise than in accordance with the instructions furnished by us. Accessories not manufactured by us are not covered by the warranty. No equipment manufactured by Ray Jefferson® is warranted in any respect if it has been repaired or altered other than at authorized service agencies.

This warranty is in lieu of all other warranties expressed or implied and no representatives or persons authorized to assume for us any other liability in connection with the sale of our products.

CONSEQUENTIAL DAMAGE:

Ray Jefferson® shall not be held liable for any damage of a special or consequential nature with respect to merchandise sold or delivered, or service rendered.

Ray Jefferson® reserves the right to perform modifications or improvements on its products without incurring obligation to install the changes on previously sold equipment.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

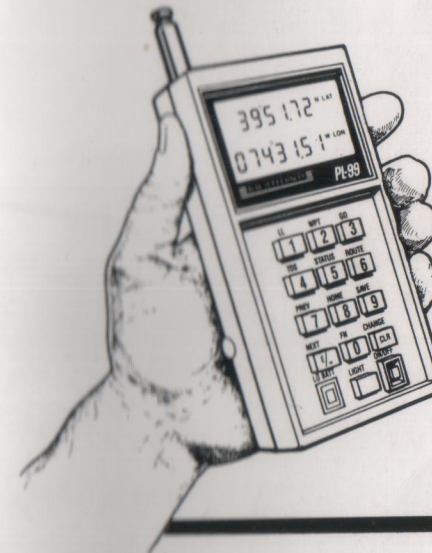
RAY JEFFERSON®

DIVISION OF JETRONIC INDUSTRIES, INC.

4200 Mitchell St.

Philadelphia, PA 19128

AUTOMATIC PORTABLE/FIXED LORAN-C RECEIVER MODEL PL-99



INSTRUCTION HANDBOOK

RAY JEFFERSON®

THE QUALITY DOESN'T COST MORE...IT'S INCLUDED

Division of Jetronic Industries, Inc.

4200 Mitchell Street • Phila., PA 19128

PRICE
\$10.00

RAY JEFFERSON MODEL PL-99 LORAN RECEIVER

Message to the Owner:

Congratulations and our thanks for choosing the Ray Jefferson Model PL-99 Loran-C Receiver. Throughout the development of our product, we have been concerned with creating a unit that offers the latest loran technology and the greatest loran value for your money. Selection of features, ease of use, superior performance and a rugged, modern package were our primary design considerations for this product. The Model PL-99 combines computer technology with an advanced software program which includes crosstrack error (CTE) display. The PL-99 provides the flexibility of a navigation unit that is fully portable without either power connections or a loran antenna coupler or, it can be permanently installed. You will soon realize how easy it is to operate this unit which presents important navigation information on a large screen with a minimum of user keyboard commands.

For permanently mounting the PL-99 a gimbal mount with thumb screws, fused 12VDC power cord and an antenna coupler are available in an accessory kit—part number AP-1. Also available is a padded carrying case that will make the unit easier to transport—part number CB-1.

It is important that you study this operation manual and complete the WARRANTY REGISTRATION CARD and return it as soon as possible.

TO: RAY JEFFERSON

Division of Jetronic Industries Inc.
4200 Mitchell St.
Philadelphia, PA. 19128

Phone: 215 487 2800

STEVE KOFF SALES MGR.

THE PRUDENT NAVIGATOR

Navigation based solely on one method or one instrument should **never** be practiced. The PL-99 Loran-C should be considered as an aid to navigation, not as the only means of navigation. While the Loran-C system is usually reliable and accurate, certain conditions and some locations may cause deterioration in performance of this or any other Loran-C system. It is important for the new user to learn about the limitations of this system, and to be aware that the repeatability of Loran-C is generally several times better than its absolute accuracy. Whenever there exists a potentially life threatening or property risking situation, one should never depend on a single instrument as the sole means of navigation. Use more than one proven navigational method to double check your position and course.

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WARRANTY INFORMATION

Ray Jefferson provides a non-commercial use, limited one-year warranty on the PL-99 Loran-C. Please note that there are limitations to our warranty. We strongly urge you to read this warranty reprinted at the back of this manual and to closely follow its terms and conditions should your receiver require repair. Please note that all repair work performed during the warranty period must be performed by Ray Jefferson for the unit to remain under warranty.

This unit is shipped to the user with rechargeable NiCad batteries installed. It is the user's responsibility to understand and perform reasonable battery care. The batteries ARE NOT covered by any warranty. They are NOT user replaceable. They *will require* charging by the user prior to operating the PL-99. When first purchased, the PL-99 may NOT turn ON or indicate LO BATT. This is NORMAL. Charge the NiCad batteries with the 115VAC wall charger for 4 hours. Carefully read the section in this manual on Battery Care. (Page 18)

Caution:

When using the wall charger, plug the charger into the PL-99 first, then plug the charger into the 115VAC outlet. *Do Not* turn the unit on or use the unit while it is plugged into the 115 VAC wall charger.

It is generally recognized that many problems experienced by Loran-C users are not caused by a defect in the unit, but instead are often the result of the user not completely understanding proper methods of operation or by poor installation.

Therefore, we strongly recommend that should you experience a problem with your PL-99 you first call Ray Jefferson at 215 487-2800 and ask to speak to our Customer Service Department. We also urge you to **read this manual** cover to cover before using or attempting to install your set. In the unlikely event your set does require repair, send it directly to Ray Jefferson and do not return it to the dealer who then must in turn return it to Ray Jefferson.

Warning Notices

Warning notices placed throughout this manual indicate important operational and installation cautions which should be carefully observed pertaining to your PL-99.

GENERAL DESCRIPTION—PL-99 LORAN-C

The PL-99 is a unique, full function Loran-C receiver designed around the powerful 68HC11 microprocessor. It is a compact unit designed both for portable operation and permanent installation in a variety of applications. It includes a battery charger with 115VAC power cord. For marine use it can be interfaced with an automatic pilot by using the 12VDC power cord found in the AP.1 accessory package, many fishfinders and other equipment designed to receive NMEA/0183 navigation data. The PL-99 is truly a computerized Loran-C receiver, in the usual sense plus a portable navigation device that can be taken anywhere.

Important Note:

THIS UNIT CAN BE OPERATED AS A FULLY PORTABLE DEVICE! As such, it can be taken to places where it is impossible to receive Loran-C signals. **Read this manual** carefully before using the PL-99.

A Loran-C receiver tells you where you are (displays position in LAT/LON or Loran TD's) and allows you to go to destinations (waypoints) by displaying a magnetic course and distance to the waypoint. Your PL-99 is unique because in addition to these basic functions, it displays ground and course speed, time to go (TTG), and course over the ground; and has a graphic and numeric display of cross track error (steering information). These and many other navigation information calculations are displayed on a large, backlit LCD screen.

The mechanical design is compact and constructed to be splash proof. It has an audible and graphic warning for arrival at waypoints and provides audio feedback whenever a key is pressed. All navigation information is transmitted continuously in NMEA/0183 format from a rear panel connector to interface with track-plotters, autopilots, and many types of sonars and fishfinders.

The PL-99 normally operates AUTOMATICALLY wherein the receiver selects the best stations for use in navigating. If you are an experienced Loran navigator, you may select the user-controlled NOT AUTOMATIC mode. In AUTOMATIC, the user need only to "seed" the PL-99 with an approximate LAT/LON and the receiver will acquire and track up to four secondaries on any operating Loran chain. In the NOT AUTOMATIC mode, the user selects the chain (GRI) and the stations he wishes to use.

The PL-99 calculates and displays present position in Loran time differences (TD's) or LAT/LON, bearing and distance to the destination, the waypoint number selected, course over the ground, estimated time enroute, your speed (average) and presents a graphic cross track error and directional

display. The directional display indicates navigating errors in miles and hundredths of a mile and instructs the user to GO RIGHT or GO LEFT. All directional data is automatically corrected for local magnetic variation.

All references to distance are in NAUTICAL MILES, a nautical mile being approximately 6,080 feet. Used along with the Latitude/Longitude coordinate system of navigation, a nautical mile represents one-sixtieth ($\frac{1}{60}$) of a degree of latitude (or one minute of a degree) at the earth's equator. The PL-99 Loran subsequently divides this unit of measure into hundredths of a nautical mile or approximately 60 feet. Reference to speed is in KNOTS. A conversion table of NAUTICAL miles to STATUTE miles can be found in the back of this book.

The PL-99 has a large waypoint memory which can store up to 99 destinations, fishing spots, navigational references (buoys, harbor entrance, VOR's, air fields, etc.), landmarks or course change points on a journey. A special FN (for "function") key will permit you to quickly determine the bearing and distance between any two waypoints in memory or the bearing and distance from your present position to any waypoint in memory. The memory data is retained when power is turned off or disconnected from your set, even when the LO BATT indicator is ON.

In addition, the PL-99 has a distance-adjustable arrival alarm, anchor alarm, two count-up timers, one count-down timer, a time-of-day clock and numerous other built-in capabilities. For example, your PL-99 allows ASF corrections (correction of position to a known location), adjustable speed factor time constants, detailed SNR and cycle data displays and other useful features.

The PL-99 represents the present state of both the Fixed and Portable Loran technology in one unit with one of the easiest to interpret display presentations available on any Loran set. The very low power consumption of the PL-99 permits **up to 15 hours of operation** from its internal rechargeable battery. Recharging can be done from a 115VAC wall charger or from a nominal 12VDC source, such as a car battery, boat battery or a motor vehicle's 12VDC source. *Do Not* operate the unit with the wall charger plugged in. The unit will not operate properly.

Caution:

DO NOT make an electrical connection between this unit and the electrical system of an aircraft as this may be a violation of FAA regulations.

Special Note—As you operate the PL-99 Loran, you will notice that the LCD display forms words like "EntEr" and "donE," mixing capital and lower case

letters seemingly at random. Do not be alarmed, this is not an indication of a malfunction in the unit. Actually the display board on the PL-99 can only form letters which are derived from the symbol 8. Thus it cannot produce capital letters such as "D" or "R" and must substitute lower case letters regardless of where they may appear in a word.

To assure that the text of this manual matches the actual PL-99 display, you will notice that words have been typeset using capital and lower case letters just as they appear on the PL-99 screen. Hopefully this will facilitate your understanding of the various functions that the unit is capable of performing.

THE LORAN-C SYSTEM

Loran (short for Long Range Navigation) is a system using land-based radio transmitting stations and computerized radio receivers that convert the incoming signal pulses into a "position." In North America you can get a Loran position anywhere along the U.S. and Canadian coasts, in the Great Lakes, and as far as several hundred miles at sea. In the rest of the world Loran coverage also includes part of Europe, much of the Mediterranean, Northern British Isles, N.E. Asia and Saudi Arabia. There are two U.S. mid-continent chains under construction to complete Loran coverage of the entire U.S.A. These are expected to be operational in 1991. Loran stations are grouped into "chains" consisting of three to six stations. Loran receivers must receive at least three stations from a chain to provide you with a position. The identification of a chain is a four-digit number called its "Group Repetition Interval" (GRI). You can usually use one chain (or GRI) for all your navigation needs.

The radio signals from the Loran stations consist of a series of pulses timed very precisely to one another. The differences in time of the arrival of these pulses at the receiver are called time differences (TDs).

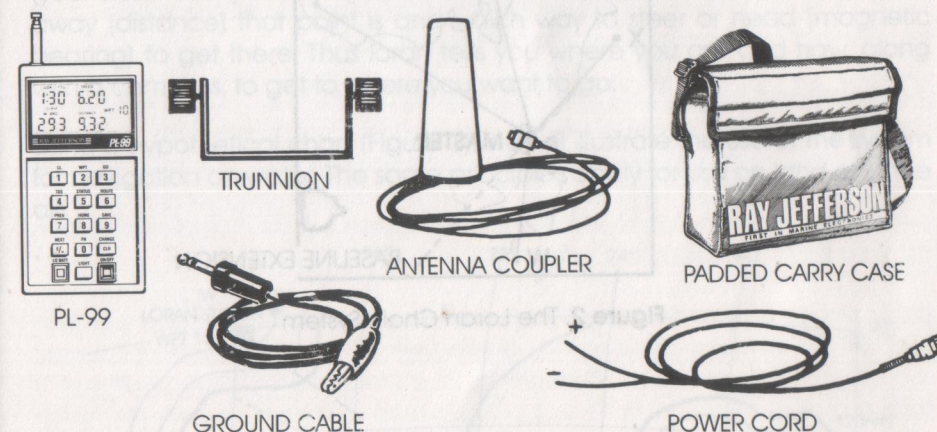
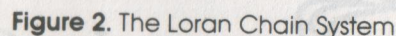


Figure 1. PL-99 Loran Receiver and Accessories

One station is called the master; the others are called W, X, Y and Z secondaries. Secondary W usually has the lowest value TD; secondary Z has the highest TD value (see Figure 2). Loran coverage maps are located at the back of this manual. As the receiver moves from one place to another, the timing between the stations changes in a measurable manner. The receiver interprets the changes in timing into a new position. Loran charts (special

For more information concerning Loran theory and use, consult The Loran-C User Handbook, published by the U.S. Coast Guard. All Loran-C users should have either this publication or one of the many other manuals and handbooks on Loran theory and operating principles.

The U.S. Coast Guard operates and maintains the Loran-C System for the U.S.A.



In this section, we will discuss some of the very basic principles and procedures pertaining to navigating with Loran. First of all, Loran is referenced to the standard LATITUDE/LONGITUDE (LAT/LON) navigation coordinate system and also is shown on some maritime charts as colored Loran TD lines. These are actually hyperbolic curves but on enlarged charts may appear to be almost straight lines. These are the lines which represent how long the signal takes to get from the Loran transmitters to you.

Loran helps you by informing you of where you are (your present position) in LAT/LON or TD's. By placing the LAT/LON or TD's of where you wish to go (your destination) in the PL-99 Loran's memory, your set calculates how far away (distance) that point is and which way to steer or head (magnetic bearing) to get there. Thus loran tells you where you are and how, along with a compass, to get to where you want to go.

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Your loran receiver measures the W, X and Y loran time delays in microseconds as: 15853, 27337 and 43359 and converts these to your LAT/LON of 39°51.27 N LAT and 75°05.14 W LON. The loran master (M) is synchronizing the secondaries (W, X & Y) and your receiver. You wish to travel to WPT 10 which is what you call the port you are hoping to reach. In your PL-99 you have entered the coordinates WPT 10 as 40°49.62 N LAT, by 76°58.11 W LON. You now instruct your PL-99 to go to WPT 10 by pressing the GO key and the display shows 310° MAG BRG 123.67 NM to WPT 10. It also shows your speed as 6.2 KTS and your ETE of 16:30 (16 hours and 30 minutes). The CHECK STATUS is OFF and your Course Display Indicator shows you should steer to the right.

In real navigation, you would normally work off a chart or map with latitude and longitude markings and enter waypoints (places) into memory and do your navigating along with a compass, going from one known waypoint to another. Another practical application is to store your starting point or home port (HOME) and enter the coordinates of airfields, landmarks or fishing spots you would want to return to later. If the weather gets bad, you press HOME for the bearing and distance back to where you started. On another day, your PL-99 Loran will help guide you back to those fishing spots, airfields, or landmarks held in memory with remarkable repeatability. You may store and go between 99 waypoints with the PL-99.

THE LATITUDE-LONGITUDE SYSTEM

Latitude-Longitude is the standard navigation coordinate system in use worldwide. On your navigation charts (and some maps) latitude lines are horizontal; longitude lines are vertical. Thus latitude and longitude lines intersect at right angles, making position plotting easy. Any place on earth may be identified by its latitude and longitude.

Both latitude and longitude are measured in degrees. Degrees are further divided into minutes. Minutes are divided into hundredths. Hence a longitude of 75°25.83 reads as 75 degrees, 25 minutes and 83 hundredths of a minute.

The Prime Meridian, a line running through Greenwich, England, divides East and West Longitudes, and is referred to as 0°. Longitudes west of 0° to 180°

are called West Longitudes (this includes all of North America); longitudes east of 0° to 180° are called East Longitudes. The Earth's Equator is 0° latitude; latitudes north of the Equator to 90° (the North Pole) are called North Latitudes; latitudes south of the Equator to 90° (the South Pole) are called

Go ► 6:30	Speed 6.20	WPT 10
M. BRG 293	DISTANCE 99	

Figure 4. Typical PL-99 Display

South Latitudes. One degree of latitude is equal to 60 nautical miles, one minute equals one nautical mile (6,080 feet). On your PL-99 Loran's LAT/LON display, the last digit is + 60 feet of latitude and + 60 feet (COS LAT) of longitude. In TD's; the last (least significant) numeral resolves to ± 50 feet.

LAT/LON VS TD'S

The use of TD's is always more accurate than LAT/LON. The loran measurements by your PL-99 Loran are made in TD's and then converted to LAT/LON in a computer algorithm. There is always some slight conversion error. However, this error is not significant except to the most fastidious navigators. Your PL-99 receiver can convert LAT/LON to TD's or vice versa in less than one second with the push of one key, so you'll always have both sets of position available at your fingertip. The best advice is to probably use the one you're the happiest with or the one everyone around you seems to use.

LORAN ACCURACY & REPEATABILITY

These two terms are frequently misunderstood and used interchangeably. Users of Loran-C should thoroughly understand the meaning of these words and the factors which determine both the accuracy and repeatability of loran in general, and your set and intended use in particular.

Accuracy means "absolute accuracy" or the difference between a known set of Latitude/Longitude coordinates and the readout of the loran set. Another term, "absolute charted accuracy" is the correlation between chart information and the Loran-C measurement in TD's shown on the display. In general, in most loran areas, absolute accuracy is limited to about ± 1/4 mile or more.

There are many factors which contribute to error, most of which have to do with terrain, intervening land and water paths, weather induced factors, errors or restrictions on the resolution of charts, and compromises and best estimates used in producing charts. These have very little to do with the

quality of the loran set. Never rely on obtaining better than $\pm 1/4$ mile accuracy as compared to a chart and never extend Loran-C TD lines from charts into bays or harbors where the TD lines may not be printed. Such extensions and assumptions can be dangerously inaccurate.

Repeatability is the ability of the set to display the same coordinates of a given place time after time. Thus places (waypoints) stored in memory can be returned to much more accurately than places the set has never been because the TD's do not tend to change as much with the time as they do with permanent terrain conditions. Typically, the repeatability to return to a place held in memory is ± 25 to ± 100 feet in many areas. So once the set "knows" the TD's or LAT/LON of a fishing hole, airfield, or any landmark by having been there, it can return you there with excellent accuracy time and again. Repeatable accuracy is one of the most reliable and unique performance features of Loran-C.

Important Note:

Some caution should be exercised during storms, especially electrical storms between the transmitters and the user since these will introduce some error in repeatability. DO NOT hold the unit with antenna extended during a thunderstorm.

Another type of repeatable accuracy is that between different loran receivers. Even receivers of identical design which are aligned and calibrated by the same technician may exhibit slight variations in reading at a given location. These are generally small (less than ± 100 feet). The fact that two sets give a slightly different answer has no bearing on their individual repeatability (± 50 feet) but only on their absolute accuracy, and both sets will still fall within $\pm 1/4$ mile absolute charted accuracy.

WHERE THE PL-99 WILL WORK

In general, the PL-99 will work in any "unshielded" place within a loran chain's limits of coverage. (See Charts of Loran Coverage Areas at the back of this manual.) The operative word here is "unshielded," and the other conditions are that the PL-99 has a suitable antenna and operating power (Lo Batt indicator not ON). The concept of shielding means any object, material, position or place that the 100KHz loran signal cannot penetrate and thus not be received by the PL-99. Things that tend to shield loran signals are: cyclone fences, buildings, dense trees or forests, power transmission lines, metal bridges, magnetic ore deposits, and strong electrical or magnetic fields.

To operate properly, the antenna of the PL-99 must be "in-the-clear." DO NOT expect the PL-99 to work in between tall buildings, in tunnels, or when

the antenna is surrounded by metallic objects. It may not work in a dense forest, but by moving to a clearing or near a creek or lake, it will probably work with the antenna fully extended. It will work in most types of aircraft with several options available for antenna arrangements (See Section entitled Antenna Considerations). If used in an aircraft, the user must be knowledgeable of FAA regulations.

PORTABLE OPERATING HINTS

When being used in the fully portable mode, there are three items of primary importance:

1. The battery should be fully charged.
2. The telescopic antenna should be fully extended and held or positioned vertically.
3. A ground will ALWAYS improve performance.

The PL-99 will operate up to 15 hrs at 70°F with a fully charged battery and the backlight off. Higher temperatures will tend to decrease the total operating time. By using the PL-99 conservatively (only when needed), it could provide many days or a week or more of service. Use the backlight only when necessary since it consumes 50% additional power when ON. Read the following section on Battery Care.

Start the signal acquisition process with the telescopic antenna fully extended. After acquisition, in many loran areas, the PL-99 will continue to operate properly with the antenna fully retracted! Hold or position the PL-99 so that the antenna is vertical. NEVER operate the PL-99 with the antenna horizontally oriented or pointed down (inverted).

The human body is a reasonably good ground and the PL-99 will automatically be fairly well grounded when held because of the conductive back grounding panel (see figure 6). When not being held, the PL-99 can be grounded using the grounding clip connected to any metallic object. Simply placing the PL-99 on a large metallic body will be effective (such as on the roof of a car). The best results however, will be obtained by using the ground clip if possible.

Stay clear of the shielding effects of buildings, transmission lines, cyclone fences or large metal objects. Be patient—the PL-99 needs up to four minutes to acquire and lock on weak loran signals. If the PL-99 does not indicate the READY condition, DO NOT use the navigation data displayed. Move to a better reception area or try a better ground.

BATTERY

The PL-99 uses a customized, rechargeable NiCad battery pack that is not serviceable by the customer. The batteries are NOT warranted since it is completely up to the user how long they will last. With proper care, they will last several years—up to 2000 cycles, which means they can go from fully charged to LO BATT condition and back 1000 times.

Note:

The user should have at least a basic understanding of the characteristics of these batteries in order to achieve maximum battery performance and life.

BATTERY CARE

The first thing the new user or owner of a PL-99 must do is **charge the batteries for four (4) hours**, after which you should be able to turn on the unit and observe that it is working. (See p. 28 ON/OFF). However, the unit should be turned OFF and charged for 8 hours or more before attempting full portable operation. The 115VAC wall charger should be used or by using the optional power cable the unit can be connected to a live 12VDC source. If connected immediately to a boat or vehicle 12VDC supply, the 12VDC supply should be left ON with the PL-99 turned OFF to fully charge the NiCad batteries. DO NOT operate (leave ON) the PL-99 while the NiCad batteries are being charged. The PL-99, although it left the factory with fully charged batteries, requires charging even though it has not been turned ON. This is because of the inherent gradual self-discharge characteristics of NiCad batteries. The rate of self-discharge is approximately 50% of capacity in 6 months at room temperature 68°F (20°C). This rate is greatly accelerated at elevated temperatures, so store your PL-99 in a cool place when not in use. Ideally, it should be kept in your refrigerator, although this is not a necessity except in very hot localities.

Caution:

When charging the PL-99 with the wall charger plug the cord into the PL-99 charger receptacle FIRST, then plug the wall charger into the 115VAC outlet.

The PL-99's built-in battery charger is designed to sense the battery condition and automatically regulate the charging rate. If power is connected continuously to the PL-99, the batteries will receive a trickle charge which maintains full charge without overcharging. It is not necessary to continuously trickle charge except when the PL-99 is stored at high temperatures. However, it is recommended that the PL-99 be connected to power or the

115VAC wall charger for at least 12 hours per month, and after every use for as long as it was being operated.

Prolonged attempted use in the LO BATT condition will shorten the battery life. However, the LO BATT indication is fairly conservative and the PL-99 may be safely used **intermittently** for up to 30 minutes after the LO BATT condition is initially indicated. For example, it could be used up to 5 times for 4 or 6 minutes each time. The unit should be off for at least 15 minutes between each of these cycles. The PL-99 should be recharged for 12 hours or longer as soon as possible after a LO BATT condition occurs. The PL-99 will **automatically shut itself OFF** when the batteries are too low.

When being operated as a fixed installation with a 12VDC power source, the batteries will automatically remain nearly fully charged and be ready for portable use. Leave the 12VDC SUPPLY turned ON to trickle charge the batteries.

To **summarize** the recommended Battery Care measures:

1. Charge the batteries upon purchase initially for 4 hours then an additional 8 hours.
2. Charge batteries at least 12 hours per month, or soon after every use.
3. DO NOT operate the unit for more than 30 minutes after a LO BATT indication.
4. Use the backlight sparingly or not at all in portable use to conserve battery capacity. The backlight may be turned ON momentarily with the LIGHT button.

Warning

DO NOT attempt to change your own batteries. These are customized packs not available in stores. They will last several years with normal care. Batteries can be changed, if necessary, by Ray Jefferson. ALWAYS try to charge your batteries before calling the factory. Opening your PL-99 will void your warranty.

INSTALLING THE PL-99 LORAN

General: This section is written for those who intend to use their PL-99 Loran-C Receiver primarily on a boat or in a vehicle with a 12VDC power source. There are generally four good methods to use when installing a Loran-C Receiver such as the Ray Jefferson PL-99.

1. Have your local Electronic Technician do the work.
2. Order your PL-99 Loran with a new boat purchase and have the dealer install it.
3. Get an experienced friend to assist you.
4. Do it yourself. This section is written for those in categories 3 and 4.

You will need ordinary hand tools and a small power drill will be useful. Plan your layout giving consideration to convenience, access to power and freedom from interference; and read all parts of this section before starting to work. You will need to purchase the Accessory Package (Part Number AP-1) to install the PL-99 on an RV, boat or other vehicle. AP-1 includes the antenna coupler with 30' of cable trunnion, thumb screws and 12VDC power cable.

PLACEMENT OF COMPONENTS

There are only two components to place: PL-99 Loran receiver and its Remote Antenna Coupler. A trunnion found in the AP-1 accessory package is provided for mounting the PL-99; you can use the trunnion base as a template. It has four holes, and you should use all four. The PL-99 may be installed in any position (See Figure 4), but remember you must be able to read the display and reach the key pad to operate the loran. You must get 12VDC power to it, ground it and connect the Remote Antenna Coupler to it. Also it should not be installed next to a fishfinder or equipment with a switching power supply. It is best to keep the Loran at least 6 feet away from a video fishfinder. Place it in a dry place on a surface which does not vibrate excessively.

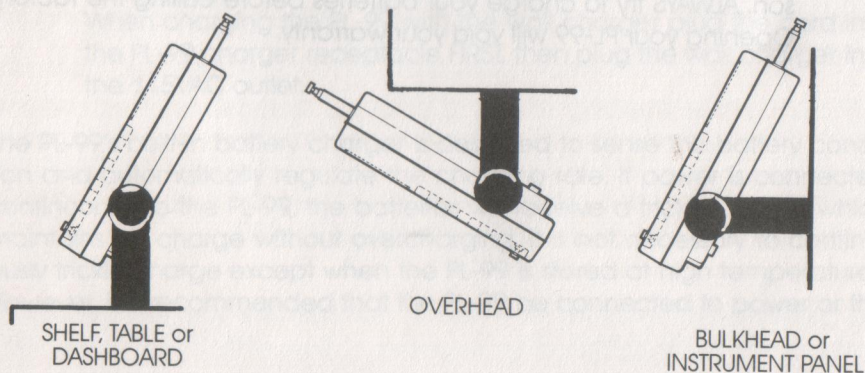


Figure 5. Receiver Mounting Options

Next, you will need to buy a standard marine antenna base with a 1"-14 thread and an eight foot (8ft.) fiberglass Loran-C Antenna with a 3/8"-24 thread. A 4 ft antenna will suffice in most good Loran reception areas but may not work well in fringe areas. These are common, inexpensive items found at most marine or electronics dealers and through marine/electronics catalogs. There is 30 feet of cable from the antenna coupler to the receiver. After preselecting the placement of items, install the trunnion and antenna mount and go to power connections.

POWER CONNECTIONS

The PL-99 Loran requires a power source with a voltage level from 11 to 16 VDC. Low voltage may cause a dim display, weak alarm, and insufficient battery charging. The LO BATT indicator will eventually turn ON. High voltage may eventually result in failure of some internal part. The nominal voltage found on most properly operating marine power systems is 13.6VDC. It is recommended that you check the voltage supply from which you intend to operate for the proper level.

Attach the four-pin connector on the end of the power supply cable found in the accessory package AP-1, to the power supply receptacle located at the rear of the unit. Connect the red wire to the positive terminal and the black wire to the negative terminal of your boat's 12VDC battery. (Figure 6). Note there are two other wires covered by a jacket. **DO NOT** connect these to the power source, they are for sending serial data to a fishfinder or auto pilot.

Caution

Double check the polarity of the power connection to avoid blowing the fuse and possibly damaging some internal circuits. If the internal circuits are damaged because of connecting the PL-99, it will be obvious to the factory technician. A repair charge will be made in such a case.

Most newer boats and larger boats have a breaker panel distribution system including some filtering. If you have such a system connect the power cable to the circuit(s) dedicated for electronic instruments. It may be necessary in some cases to use an electronic interference filter. (See Page 50 for further discussion on interference.)

The 12VDC power leads should go directly to the boat or other vehicle's battery or main distribution panel. To further minimize the potential of electrical interference, carefully route the power cord so that it does not run parallel or close to your depthsounder transducer cable, engine, refrigeration, bilge pumps or any other pulse carrying wiring.

The power cord has an in-line fuse holder with a 1/4 ampere fuse installed. Be certain when connecting the power cord to the battery that the correct polarity is observed or the fuse may blow and possible circuit damage may occur. **DO NOT** open the black jacket near the receptacle unless you intend to use the serial output data.

Warning:

Never replace the PL-99's in-line fuse with a higher rating. **NEVER** use a fuse rated at more than 1/4 Ampere. Always replace with a 1/4 ampere fuse. Correct polarity must be observed or circuit damage may occur.

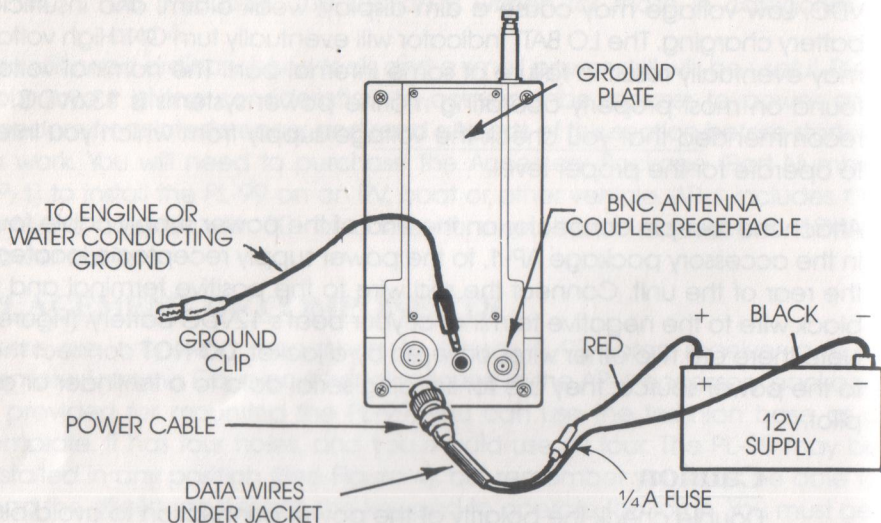


Figure 6. PL-99 Receiver Connections

GROUNDING THE LORAN RECEIVER

Although it is designed to operate as a hand-held portable, a good ground will ALWAYS improve the performance of your PL-99 Loran-C receiver. Also, a good ground will help to minimize the effects of electrical noise and improve the receiver's ability to track weak loran signals.

You should run the black grounding wire from the charger receptacle on the rear of the unit to a good water or earth ground. The wire should run as direct as possible and *should be run in addition* to the 12 VDC ground lead on the power connector. It may not be sufficient to simply connect the ground lead to the negative side of your vehicle's battery. The boat's negative battery terminal may not have a good connection to water ground.

Examples of good grounding points are the boat's engine, water tanks, metal thru-hull fittings and keel bolts. Some boats are manufactured with a grounding system throughout the boat to prevent electrolysis

damage. These "bonding" systems are excellent ground points. Even attaching the unit to a large metal object will be beneficial. As will continuous contact between the users hand and the metal grounding plate on the back of the unit. Note that it is important that these ground connections are electrically "clean." Prepare the surface of these "hard" or more permanent connections by brushing or sanding the contact points to insure a good electrical connection. Lubricate over the connections to help minimize electrolysis corrosion.

ANTENNA CONSIDERATIONS

When used as a portable or hand-held, the removable telescopic antenna should be attached and fully extended until the "READY" condition is established. After that, in many areas the antenna may be shortened to a convenient length. However, it cannot be allowed to touch any metal object or your hand, which will ground the antenna. The antenna should remain vertical, in-the-clear, and if possible, the ground wire connected to a known ground or large metallic object. It is not necessary to ground the unit if continuous hand contact is made to the metal grounding plate on the back of the unit.

The remote antenna coupler found in the AP-1 accessory package is designed specifically for this unit and will not work with others. It is designed to be used with a 4 foot or a standard marine 8 foot fiberglass Loran-C antenna with 3/8-24 threads, and an antenna mount with 1-inch threads. This item should be available from the dealer who sold you the PL-99 Loran or any other marine electronics dealer. When using the remote antenna coupler, remove the telescopic portable antenna and use an 8-32 plastic screw (provided with set) to plug the telescopic antenna hole. This will help keep out water and foreign material.

DO NOT use an antenna coupler manufactured by other manufacturers since it probably won't work and may damage your PL-99 Loran! The Antenna Coupler comes standard with 30 feet of coaxial cable. Because many of the problems experienced by Loran users are the result of faulty antenna connectors, we recommend that you do not cut the cable and re-install the connector. Instead simply coil the excess cable and locate it out of the way. If you need to increase the length of the coaxial cable we recommend that you consult an experienced electronic technician.

Note:

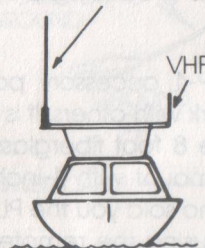
The PL-99 Loran has an SNR display that can be used to help you determine the optimum antenna location. Therefore, it is a good idea to first mount your antenna temporarily and check its performance before deciding on the final mounting location. (See Page 53-54 '... SNR INTERPRETATION' for explanation of the GRI status displays).

TYPICAL PERMANENT ANTENNA LOCATIONS

The location of the antenna is of utmost importance. In general, the antenna should be located as high and as much in the clear as possible. It should not be located beside or below large metal objects which are close-by as they will tend to shield the antenna from receiving signals. In addition, the loran antenna should not be located in a position where other wires, antennas or metal pipes run parallel to it. (For example, make sure your Loran antenna is mounted at least 6' away from your CB or VHF antenna!) See Figures 6 and 7 for typical antenna placements on power and sail boats.

It is also important to realize that most Loran interference problems caused by video fishfinders and other electronics are caused by radiation to the Loran antenna. Therefore, it is advisable to mount the loran antenna as far as convenient from the location of your fishfinders, etc. Do not have the screen of a video fishfinder or T.V. set looking toward the antenna.

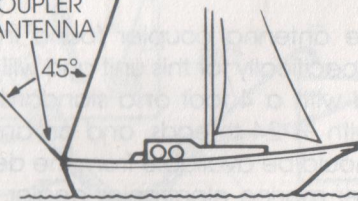
COUPLER & ANTENNA



POWERBOAT

Figure 7.

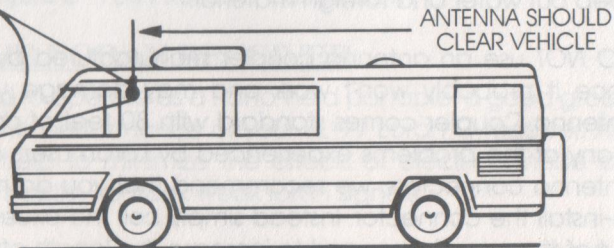
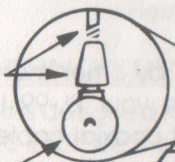
STAY
COUPLER & ANTENNA
45°



SAILBOAT

Figure 8.

COUPLER & ANTENNA
MARINE OR CB
ANTENNA MOUNT



RECREATION VEHICLE

Figure 9.

On small open boats, a good loran antenna placement is often on the rail at the bow or stern. Most marine dealers offer antenna mounts that are designed to mount on your boat's rails. On a truck, camper or other RV the exterior rear view mirror mounting brackets work well. Look for a "trucker" CB antenna mounting bracket at an electronics or radio shop. See Figures 7, 8 and 9 which are a graphic representation of how to locate your antenna away from the shielding effects of objects nearby.

The antenna principle is based on a vertical, non-inductive wire nominally 24 to 30 inches in length connected directly to the PL-99's telescopic antenna receptacle. Anything that closely simulates this with minimal capacitive shunting will suffice as an antenna. Use the STATUS display described later in this manual as a meter or gauge to measure the relative effectiveness of your proposed antenna scheme as compared to the fully extended telescopic antenna. The best antenna configuration, wherever possible, is an 8 ft whip and the remote antenna coupler.

Again, REMEMBER that a good ground connection, while not necessary for satisfactory reception, will ALWAYS improve the performance of the PL-99 with any type of antenna.

OTHER ANTENNA OPTIONS

There are many other possible types of antennae and configurations that will work well with the PL-99. A few of these are discussed here. The user is advised to experiment but, within the guidelines discussed herein. Ray Jefferson Customer Service Department can be contacted for additional assistance and applications support.

In general, any vertical wire or combination of a vertical antenna and cable can be used as long as it is in-the-clear and of sufficient length. NEVER use an antenna with a loading coil (such as a CB antenna) or with high inductance (coils), such as "Rubber Duck" types of antennas.

There are several kinds of car antennas with short lead-in cables (36"-48") but, not exceeding 72" in length that will work well with the PL-99. Don't use an antenna whose cable length exceeds 6 feet.

Warning

NEVER connect any antenna to the PL-99's BNC (back of cabinet) connector except the remote antenna coupler furnished with the AP-1 accessory package. The BNC connector is especially connected internally to match the PL-99 with the antenna coupler. Use

CONE OF ACTIVE RECEPTION

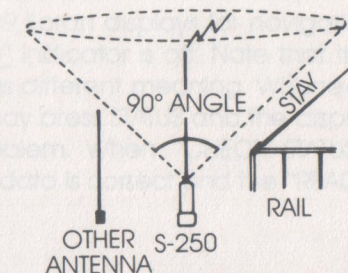


Figure 10.

an 8-32 screw to attach only your antenna's center lead to the hole formally occupied by the telescopic antenna. See Figure 11. It is not necessary to ground the shields of short runs of coaxial cable (36 to 48 in.). Careful! Don't allow the shielding to come in contact with the center lead. If longer cables (up to 12 ft maximum) are used, ground the cable shield. A longer antenna is needed if longer cables are used to compensate for signal loss in the cable. Use 4" of extra antenna length (added to 24") for each foot of lead-in cable.

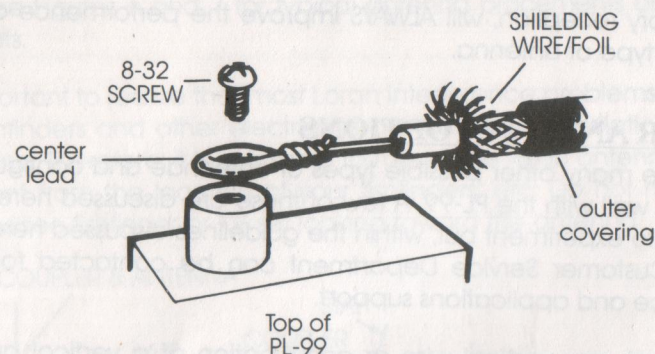


Figure 11. ATTACHING OTHER ANTENNAS

Automobile antennas may also be used on small boats, RV's, snowmobiles and dune buggies or ATV's. The recommended method of receiving in aircraft is simply a 24 to 36 inch length of insulated wire which may be held vertically by a suction cup on the windshield or clip to the head-liner.

Caution:

DO NOT make any connections to any part of the aircraft electrical system or communications equipment as this is a violation of FAA regulations. The PL-99 is NOT APPROVED for IFR navigation or instrument approaches.

BASIC PL-99 LORAN OPERATION

General: The Ray Jefferson PL-99 Loran operating system consists of the large LCD presentation and twelve key keypad plus an ON/OFF switch, LO BATT indicator and momentary backlight button as shown in Figure 12, Page 28. The LCD and keypad comprise the Control Display Program (CDP) which was designed for simplicity and user convenience. All commonly used loran navigation and directional (steering) information is displayed on a large LCD screen. To call up waypoint locations and to perform numerous other calculations and to observe loran signal status, the user performs simple keypad operations which are explained in this section.

The fourteen keys are used for the "function" that is written prominently above the key. Only when the CDP expects numeric values are the keypad "numbers", rather than the "functions" used; and then the CDP prompts the user.

Important Note

Although at first glance the keys on your PL-99 Loran appear to be dual function, they actually *are not*. When the PL-99 is expecting "numeric" inputs (position, waypoint numbers, etc.), it will display a format of underlines on the display with the location of the current required entry blinking. Only when there is a numeric response required because of some user initiated action do the keys become numeric. Think of the keys as FUNCTIONS.

All displays are fully annunciated and prompts are always provided. Latitude and longitude degrees always have degree marks as do bearing and course over the ground (COG) readouts. Distance and speed are auto-ranged; when less than 10 or 100 the decimal points are automatically provided. All common loran navigation functions are easy to select and interpret by casual loran users. Only the less familiar functions probably not of interest to most navigators are "hidden." Access to these "FUNCTIONS" and special calculations are described under FN in this section and in the SPECIAL FUNCTIONS portions of this manual.

Warning:

Never use the PL-99 Loran displays for navigation purposes unless the "CHECK STATUS" indicator is off. Note that there is an "ALARM" indicator which has different meaning. Whenever "CHECK STATUS" is displayed, you may press STATUS and the display will indicate the nature of the problem. When "CHECK STATUS" is off, you may assume all display data is correct and the "READY" condition exists.

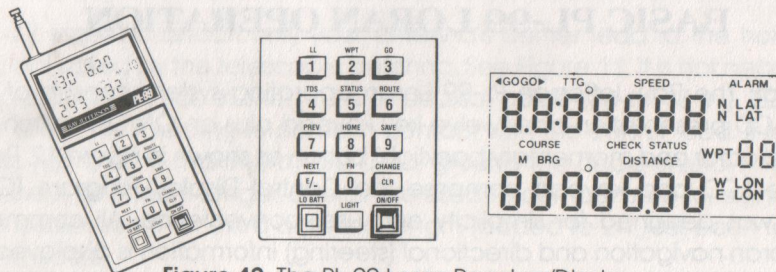


Figure 12. The PL-99 Loran Receiver/Display

KEYPAD DESCRIPTION

The PL-99 keypad is a custom designed silicon rubber keypad which is water resistant and rated for over one million operations per key. The keys should be pressed firmly in a deliberate manner. The CDP (Control Display Program) systems of the PL-99 are designed for accuracy and reliability, not for speed, and each entry is presented on the display as it is accepted. Note that there is no ENTER key as on some loran receivers.

The following is a description of the function of each of the PL-99 receiver's keys. You will want to read this section quickly for reference *and then again* after reading the remainder of the section to thoroughly understand the entire PL-99 CDP.

ON/OFF

A pushbutton in the lower right corner of the PL-99. This switch is intentionally difficult to operate to minimize the possibility of accidental turn-ON which would discharge the internal batteries. It must be held in for 3 to 5 seconds to turn the PL-99 ON or OFF.

LL

Commands the PL-99 to display your PRESENT POSITION in latitude (annunciated N LAT) and longitude (annunciated W LON or E LON).

WPT

This key is used to display any WAYPOINT. The CDP will ask you to enter the number of the WPT desired. If you wish to enter a new value in either TD's of LAT/LON into the WPT#, press CHANGE, and enter the new coordinates. The displayed waypoint, whether changed or not, becomes the destination waypoint.

GO

After displaying a selected WPT#, press GO for the bearing and distance to that waypoint. After that, the GO key toggles between TTG (Time To Go); COURSE (Course Over the Ground) and CTE (Cross Track Error) with the steering indicators.

TDS

Converts present position LAT/LON to TD's or WPT LAT/LON to TD's. Press again to switch back to LAT/LON. Press CHANGE to display the remaining TD's, which may be 0, 1 or 2 additional TD's depending on the GRI you are operating in. Used in conjunction with the LL key.

STATUS

This key displays which GRI is being used, whether the PL-99 is in the A (Automatic) or nA Manual; (Not Automatic) mode, and the status of each station in the GRI (chain). A more comprehensive discussion of the interpretation of the STATUS displays is given elsewhere in this manual.

Also, when used along with the CHANGE key, it will initiate a sequence that will allow you to manually insert a GRI discussed further on Page 35.

Ready ———→ 9. 92983 ←—— SNR of M, W, X, Y, & Z stations
GRI is 9960 ———→ GR19960 ←—— R Automatic Mode

Figure 13. GRI Display

ROUTE

Permits selection of one of the 10 preprogrammed routes of 9 waypoints for autorouting or chaining together of waypoints. It also initiates the program and displays for entering or changing of routes. (See Page 56).

PREV

This key, the opposite of NEXT, is used with the SAVE, WPT and ROUTE keys to step backwards to the previous WPT numbers.

HOME

Waypoint 99 is reserved for storing your HOME or starting position WPT. Whenever HOME is pressed the CDP displays the bearing and distance HOME for quick reference or in the event of an emergency.

SAVE

As expected, this key "saves" or stores the Present Position in any waypoint memory address (00 to 99). The CDP will ask you which waypoint number you want to hold or SAVE the waypoint in. If you select 00, the start navigation point is updated to your Present Position, thereby resetting your cross-track error to 0.00.

NEXT

If NEXT is pressed after SAVE, the present position will be saved in the waypoint which comes "next" after the last "save". For example, if SAVE NEXT follows SAVE 3 1, the present position would be saved in waypoint 32; the next time, waypoint 31, etc. When in ROUTE, NEXT sequences the route WPT's. When displaying a WPT, NEXT sequences to the next WPT. When displaying TD's, NEXT changes the TD's being displayed.

E/-

This key has two functions. When entering longitudes, anytime during the longitude entry of 7 digits the E is pressed, the calculations will be made based on East Longitude (annunciated E LON). The minus (-) portion permits entry of negative numbers for jumps (see SPECIAL FUNCTIONS).

FN

Allows the operator access to many special calculations or functions (FN) which are not frequently used by casual navigators. The PL-99 will request a function number when FN is pressed. The "functions" include turning the backlighting on and off, setting manual ASF correction control, magnetic variation calculation, setting the arrival alarm distance and the speed time factor, calculating the bearing and distance between two waypoints, calculation of TD's of any waypoint, setting and displaying of the various clocks, and many others (see SPECIAL FUNCTIONS Page 60 for listing).

CHANGE/ CLR (CLEAR)

This key has different functions depending upon what is being displayed. If the PL-99's CDP is waiting for a numeric entry, CLR is a "backspace". It also allows you to exit or get out of certain special functions, or allows you to go to a new destination. Whenever CLR is pressed while in the "GO" or navigation mode, the PL-99 will ask if you want to go to a new WPT. When used in conjunction with the STATUS key, it will take you into the manual insertion of a GRI (page 35).

0-9

Whenever the PL-99 CDP is expecting a numeric input, it will display a flashing underline or cursor and the keyboard numerals are entered as on a telephone keypad. The CDP will wait until all of the required or expected numeric entries are completed before changing. If you make a mistake on your entry, press CLR and re-enter the correct values.

LIGHT

Press this button to momentarily illuminate the display light. Continuous backlighting should be done only when operating the PL-99 from external power.

LO BATT

This is a small red light at the left side of the lower row. When ON, it signifies that the battery has lost most of its charge. DO NOT operate the PL-99 more than 30 minutes **intermittently** with a LO BATT indication. Recharge the battery as soon as possible. LO BATT will blink once at turn ON and again at turn OFF to indicate it is working.

DISPLAY DESCRIPTION:

The PL-99 Loran has a unique liquid crystal display (LCD) system which provides the user with key navigation information and a graphic course deviation indicator (steering display) simultaneously without having to press keys and change formats.

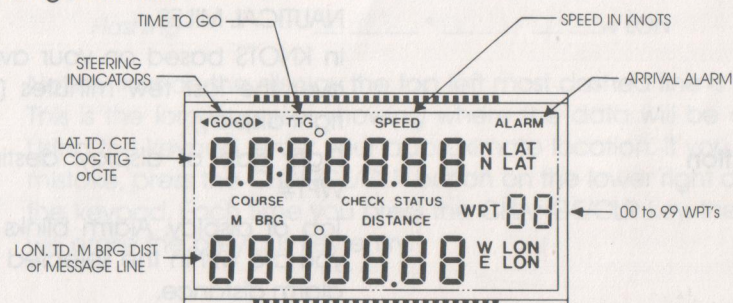


Figure 14. The PL-99 Display (Not all of the annunciators are lit at once except in start-up and Function 20.)

All of the following information used in navigation is displayed on the PL-99 Loran's LCD:

NAVIGATION FUNCTION

Present Position

LOCATION & DESCRIPTION

Main two lines. Press LL for present position in LAT/LON press TDS for present position in TD's.

Status

CHECK STATUS warning is shown just above DISTANCE. Don't use the PL-99 for navigating when CHECK STATUS is on.

Cross Track Error (CTE)

In nautical miles OFF course resolved to 0.01 NM. Display is in upper left corner and functions with the left and right GO arrows.

Steering Display

Upper left corner GO LEFT and GO RIGHT arrows.

Magnetic Bearing (M BRG)

Lower left—bearing in degrees to the destination waypoint.

Time To Go (TTG)

Upper left corner shows the time in hours and minutes at the present speed to the destination WPT.

Course (COG)

Course over ground is actual path you are following to the destination WPT.

Distance

In nautical miles resolved to 0.01 NAUTICAL MILES to the destination WPT up to 9.99 NAUTICAL MILES after which unit reads in whole NAUTICAL MILES.

Speed

In KNOTS based on your average over the last few minutes (upper right display).

Destination

Right side of display, destination WPT#.

Alarm

Top of display. Alarm blinks when you are within the selected arrival alarm distance.

The only display function that changes in normal usage is the information in the upper left portion of the display. This is a toggle display which is controlled by the GO key. It toggles or alternates between COG, CTE and TTG as described above.

Caution:

DO NOT attempt to operate your PL-99 until you have connected the unit to either a 12VDC power source or the 115VAC wall charger. See BATTERY CARE page 18. The PL-99 batteries require up to 12 hours of charging before portable use.

INITIAL TURN-ON

When you first receive your PL-99 Loran, it will have no waypoint or random information in its memory and have no idea of its location. You will need to initialize it by letting it know your approximate location. Refer to Appendix B to find the Latitude and Longitude coordinates of the Start-Up position nearest you and be ready to enter them into the PL-99 when turned on. Once the PL-99 knows its location it will store it in its memory and automatically initialize itself when turned on in the future. When you first tell the PL-99 Loran its approximate position it then determines the best loran signals to use in calculating your position and also stores them for future use. Your loran is now operating in the AUTOMATIC MODE:

Note:

The telescopic antenna must be fully extended and held in a nearly vertical condition until the signal is locked-in. The antenna may be lowered after that.

1. To turn your PL-99 on, press the ON/OFF key and your set should respond with a BEEP and the display will show:

<i>1st:</i>	<i>Then:</i>	<i>Then:</i>
PL-99	PLEASE	L-L = 4
LORAN — C	CHOOSE	GRT = 7

2. Press the 4 key to choose a LAT/LON entry (see page 78). The display will then show:

<i>1st line</i>	____ ° ____ · ____ n LAT
<i>Flashing</i>	____ ° ____ · ____ w LON

3. Notice that on the display the top left most dashed line is blinking. This is the loran's curser showing where the data will be entered. Using the keypad, enter your approximate location. If you make a mistake, press the CHANGE/CLR button on the lower right corner of the keypad. Each time you press the CHANGE/CLR key, the display will erase the previous key entry.

As an example: 39°50.07 North Latitude by 075°10.09 West Longitude should be entered as shown below. If West Longitude is less than 100 add a 0 (zero) at the bottom left dashed line on the display (see tables beginning on page 78).

39°50.07 N LAT
075°10.09 W LON

Figure 15. A Typical LAT/LON Display

The PL-99 automatically assumes all entries are in North Latitude (N LAT) and West Longitude (W LON). If you are East Longitude, you may request E Lon at any time during the longitude entry by pressing the key labeled (-/E) on the lower left corner of the keypad. It makes no difference when you press the (-/E) key as long as it is before the 7th longitude digit entry. When East Longitude is chosen, the annunciator will show E LON.

4. When you complete your approximate position entry, the PL-99 display will change to show the status of the received signals. If you had entered the numbers in the example above, the display would then change to show the following:

0 = NOT ready → 0. ccccc A ← A = Auto or
or 9 = Ready 6r, 9960 nA = Not Auto
↑
Gri 9960

Figure 16. Signal Status Display

The top line of the display is showing the status of the received signals. The bottom line is showing the GRI or CHAIN that the Loran is using. The GRI or CHAIN was automatically determined by the Loran receiver based on the initial position information entered. The letter "A" in the right center of the display lets you know that PL-99 is operating in the Automatic Mode.

It will take up to four minutes for your set to "lock-in" on the loran signals and do the calculations required for valid position. During this time the top line of the display will at first show all c's, indicating that the loran is trying to locate and lock-in on the signals (cycle select). After about a minute several of the c's should change to a number indicating the approximate strength of the receive signal with "9" being the best.

Your PL-99 Loran needs to have at least three of the c's change to numbers in the upper display in order to determine your position. Once this has happened, you can then press the key labeled LL and the display will change

to show your current updated position. Notice that between the latitude and longitude displays there is an annunciator which says "CHECK STATUS." When the PL-99 locks on the loran signals and satisfies certain quality tests of the signals, CHECK STATUS will go OFF. When CHECK STATUS is shown you should not use the loran information for navigating.

Warning:

Never use the PL-99 Loran position information when the CHECK STATUS indicator on the display is on or a TD digit is blinking.

MANUAL GRI ENTRY

Your PL-99 Loran has the capability of accepting a GRI manually rather than automatically as described on the last few pages. If you are are operating your loran in overlap areas such as between the 7980 and 9960 GRI's you may want to manually select a chain by using the following method. You must press the ON key, then immediately press CHANGE. To enter a different GRI press yes = 1 then enter the GRI numbers. "GRI _ _ _".

Note:

This manual GRI entry **must** also be usable in your area. Manually entering a GRI will always put the PL-99 Loran into the NOT AUTO mode. See page 38. The PL-99 in the NOT AUTO mode can produce unpredictable results and should be used only by experienced loran navigators.

Warning:

Never use the PL-99 Loran position information when the CHECK STATUS indicator on the display is on or a TD digit is blinking.

NORMAL ON-OFF

1. Press the ON/OFF switch and hold in for 3-5 seconds to turn ON. The horn will beep, letting you know the PL-99 is ON, and a display message will appear. To turn OFF, hold the ON/OFF switch in for 3-5 seconds. The PL-99 is intentionally difficult to turn ON and OFF to prevent accidental ON which would discharge the internal batteries. LO BATT blinks when the unit is turned ON and turned OFF.

2. The PL-99 Loran's display should successively show:

1st:	Then:
PL-99	0 ccccc
LorAn - C	Gri 9960
	(or whatever GRI the set was turned OFF with)

A

3. As the set starts to acquire and track loran signals, the display will automatically show the SNR numbers (Signal to Noise ratio, see Glossary) for the stations.
4. It will then take about two to four minutes for the set to completely "lock-on" the loran signals. Press the LL key to see the Latitude/Longitude of your present position.
5. After the PL-99 has completely "LOCKED-ON" its signals, it will extinguish the "CHECK STATUS" indication and you may rely on the positional and navigational data.

BACKLIGHT

The PL-99 has an aviation red LED light pipe backlight for night viewing. The backlight is a solid-state light which is turned ON and OFF by pressing the LIGHT button or FN 00. When the PL-99 is turned OFF, the backlight automatically goes off and will be off at the next turn ON. DO NOT use the backlight during daylight hours. It may be only marginally effective during twilight.

Warning

The use of the backlight should be restricted in fully portable operation to momentarily pressing the LIGHT button. The backlight consumes 50% additional battery power when in use. The backlight may be left on continuously when external power is being applied.

STATUS OR GRI DISPLAY

When the PL-99 is first acquiring loran signals, it will automatically switch to the GRI mode or STATUS display. In this condition, the display indicates the relative SNR's for each station in the loran chain. At other times, you may observe the signal status by pressing the STATUS key. You may enter a GRI manually, see p. 35.

The upper 1st digit is the Ready Indicator: 9 = Ready and 0 = Not Ready.

When in the GRI or STATUS display the top line shows the strength of the signals (SNR) being received, with a 9 being the strongest signal. The first digit is the SNR of the MASTER station, and the next digits indicate the status of the W, X, Y, and Z stations respectively. Note that some loran chains only have a Master and three secondary stations, or slaves W, X, and Y.

Other numbers in the top display will indicate the following:

- c Indicates that the PL-99 is trying to lock onto the signal (cycle select small letter c).
- b Indicates that the loran station is broadcasting a warning that it should not be used (referred to as a blink condition. Small letter b).
- o Indicates that there are no signals from this station. (Small zero).
- 0-9: Signal strength-to-noise ratio, with 0 being about - 15db and 9 being about 0db. An 8 or 9 means the signals are very strong. The letter "A" or "nA" in the right hand portion of the display indicates whether the PL-99 is in the Automatic (A) or Not Automatic (nA) mode.

Note:

The STATUS or GRI display is a valuable troubleshooting aid when trying to optimize your PL-99's location, antenna placement or configuration, or for tracking down sources of interference.

Once the PL-99 has acquired the signals and the STATUS or GRI display is showing the signal SNR numbers, you can then change the placement of the antenna and look for improvement. Note that after you move the antenna you must wait for at least two minutes for the loran to show the new result on the display. If the numbers on the display increase then you can assume that the new antenna location is better than the original.

Similarly, the STATUS/GRI display is a useful tool in locating offending sources of noise in the loran. First, a boater or motorist should turn off your engine and all other possible sources of noise (including fluorescent lights, fish-finders, radios, water pumps, refrigeration systems, TV., etc.) and the loran signals have been acquired and locked-in, note the STATUS readings on the STATUS/GRI display. Then, one at a time, turn on the suspected sources of noise while observing the numbers on the STATUS/GRI display. If you see the numbers decrease in value after turning on a piece of equipment or your engine, then you will need to try some techniques to reduce the level of interference. Some of these techniques are covered in the Section titled *Problem Analysis*.

Note:

If your display shows "nA" letters on the lower left hand side of the display press **FN 01** to select the AUTOMATIC mode of operation.

AUTO/NOT AUTO MODES

There are two operating modes of the PL-99 Loran AUTO and NOT AUTO. In the normal turn ON sequence, the PL-99 goes to the automatic (AUTO) mode when it is initialized and it will subsequently stay in AUTO unless you choose to place your set in NOT AUTO. We recommend that you always operate in AUTO unless you are an experienced loran navigator and circumstances dictate the choice of NOT AUTO operation. In AUTO, the PL-99 automatically selects the GRI and the stations within that GRI that are the strongest or best to use for your location. In this mode, if one of the stations selected is off the air or not functioning properly, the set will automatically pick another.

In NOT AUTO, the PL-99 Loran must be told which stations (TD's) to use. The set will use the TD's which are displayed on the screen and you may change them to select the ones you wish to use. However, if one of the selected stations develops a problem or becomes unusable, the PL-99 information will be in error. To operate in the NOT AUTO mode:

1. First choose GRI instead of LL when you *INITIALLY* turn on the set, the display will show: GRI _ _ _ _.
2. Enter the GRI for your location from the Start Up Locations in Appendix B.
3. While the PL-99 is trying to find and start to track the loran signals it will display.

0 ccccc nA
GRI XXXX
↑

Represents your
Gri location

As soon as your set starts to lock-in on the loran signals, the status display numbers will change. When this happens, press **LL** then **TDS** and then **PREV** or **NEXT** to choose the two displayed TD's you want the PL-99 to use to find your position. To change TDs press **LL** then **TDS** and then **PREV** or **NEXT** repeat above step depending on which TDs you want the PL-99 to use. The display will scroll thru all available TD's for that GRI and the PL-99 will use the TD's shown on the display.

Warning

In NOT AUTO, the PL-99 will not change your selected TD's, even if you travel a great distance, when other signals would give a better position. If you use this GRI turn-on, your set will not be in AUTOMATIC mode. The TD's being used are the one's displayed when you press the LL key. The user can choose the NOT-AUTOMATIC mode by two methods:

1.) If, during the first time or *INITIAL* turn-on, the user chooses to enter his Loran Chain number (GRI) instead of LAT/LON position, the PL-99 will be in the NOT-AUTOMATIC mode. The unit will stay in the NOT-AUTOMATIC mode, even if turned **on and off**, until the user changes back to AUTOMATIC mode.

2.) When operating in the AUTOMATIC mode, the user may change to the NOT-AUTOMATIC mode and vice versa by simply pressing the FN key and then entering **0 1**, and:

AUTO = 1

NOT = 4

Note

You can tell at a glance what mode you are operating in by observing the small letter at the right of the display when in the STATUS or (GRI) display mode. A letter A indicates the AUTOMATIC mode and the nA indicates the NOT AUTOMATIC mode.

We again emphasize that NOT AUTO can produce unpredictable results and should be used only by experienced loran navigators under special circumstances. Be certain to check that you are usually operating in the AUTO mode.

THE WAYPOINT SYSTEM

General: A Waypoint refers to any place on the Earth's surface you want to remember. In navigation applications, a Waypoint is usually a starting point, a destination, buoy or channel marker, an airfield runway, a campsite, mountain peak, crossroads or any place at which you wish to change course. In fishing applications, it is usually a favorite fishing spot, harbor entrance, location of a reef, a wreck, rocks or other important bottom structure which can be entered and retained in the PL-99 Loran memory.

The PL-99 Loran can store up to 100 positions numbered from 00 to 99; however, location 00 and 99 have special uses and should not be used to store waypoints. Location 00 is used by the Loran when making course and distance calculations and location 99 is reserved for use of HOME location as described later in this section of this manual.

Waypoints can be entered into the PL-99's memory by two methods; *instant* (remembering where you are) or by means of the *keyboard*. The best method to store waypoints is by the *instant* method or present position. This is because when waypoints are stored by this method the boat is actually at the location being stored. This takes maximum advantage of the inherent repeatability characteristics of the Loran-C System. Loran is extremely repeatable when the set itself has been to the location to be remembered. Transferring a position from a chart or relating your assumed position to a chart is always subject to some error. However, the determination of waypoints from chart information is the common mode of loran navigation to new areas and during times of reduced visibility. However, for the highest degree of repeatability, always enter important coordinates when you are actually at the waypoint to be retained.

HOW TO ENTER AND STORE WAYPOINTS

PRESENT POSITION WAYPOINT ENTRY

When you are at any location that you want to store in memory, the procedure is:

Note:

Observe the display's status indication. Do not store waypoints when the PL-99 is in the CHECK STATUS condition.

1. Press the **SAVE** key.
2. The PL-99 will respond with:

SAVE IN
WPT
00 _ _
40

3. Enter the number you wish to assign to the waypoint. For example, 0 5 is memory location 5, 7 9 is memory location 79, and so forth.
4. The PL-99 then displays the position you have just requested to be saved, and the WPT # is shown on the right side of the display. Any coordinates previously stored for this WPT # will be erased as the new coordinates are entered.
5. Enter the WPT # and coordinates and any comment in your WPT LOG book.
6. You may then press any key.
7. If you press **SAVE** then **NEXT** the "NEXT" present position will be saved in the waypoint number after the last saved number. For example, if SAVE-NEXT follows SAVE 31, the present position, at the instant NEXT is pressed, is saved in WPT 32; the next time, WPT 33 and so forth.

KEYBOARD WAYPOINT ENTRY

You may store any position if you know the coordinates of that position in either LAT/LON or TD's. The following simple steps permit you to load waypoints in memory, such as when planning a trip:

1. Press the **WPT** key.
2. The PL-99 Loran will ask you:

DISPLAY
WPT
00 _ _
3. Enter the number of any waypoint you wish to see or change. If you are to enter a series of new waypoints, remember, anything previously stored in those locations will be erased as the new entries are made.
4. Press **CHG** and then answer the display query: LAT/LON or TD's by pressing the appropriate key.

L-L = 4
tdS = 7

Note:

Any previous position in the memory location will be erased as the display prompts you to enter the new coordinates for the waypoint memory number you have selected.

5. You may now press any key you wish to use.

Note:

If you want to input a series of new waypoints, continue repeating Steps 1 through 5 for as many entries as you wish, or you can simply enter **NEXT** and **CHG**.

The user can always correct a waypoint entered from a chart by using the keyboard after he arrives there by simply pressing **SAVE** and enter same WPT #.

STORING YOUR HOME POSITION

Waypoint 99 is reserved by the PL-99 as a special "HOME" location. This is a convenient safety feature for you and your companions. Once the starting or HOME coordinates are properly entered, by pressing the HOME key, the PL-99 immediately displays the course, distance, present speed, ETE and directional information you'll require for getting back to where you started.

The actual coordinates for the HOME position should be a buoy, entrance to your harbor, your home, base camp, car, airfield or some other significant reference point near your starting point. It is not recommended that a boater use the actual berth or slip in a harbor as the HOME position. This is because masts, fences, other boats and electrical noise may cause an error inside the harbor and that position may not be reliable. The entrance to the channel or harbor is the best choice since it is likely to have less interference and thus better repeatability. At the same time, campers, hunters or backpackers should not use the actual campsite as HOME if it is located in a densely forested area of the woods. Instead choose a clearing within sight of the camp. In the case of an airplane, don't try to use the PL-99 inside of a hanger, use a runway.

To store your present position in the HOME (WPT #99) position:

Note:

Observe the display's status indication. Do not store waypoints in the CHECK STATUS condition.

1. Press **SAVE** >> **9** >> **9**
2. Press **GO** to return to navigation mode.

In the event of an emergency, anyone with you can be instructed to press the **HOME** key to be given navigation information to allow them to return back "Home".

Note:

The PL-99 will display either present position or a waypoint (either in LAT/LON or TD's). When the display is WPT, **WPT #** will appear on the screen. When the display is present position, **WPT #** will not be on the screen.

NAVIGATING WITH THE PL-99 LORAN

The PL-99 Loran-C Receiver includes a full function navigation computer that will calculate and display course to steer or head, distance off the desired course (cross track error), time to go, your speed, and actual course made good between your present location and any of your stored Waypoint positions. It should always be used in conjunction with a quality compass.

It is very important to understand that the PL-99 calculates a course line from a starting position (loran memory location 00) to the Waypoint and will not compute a new course line unless you CHANGE the Waypoint while in the navigation mode (or press **SAVE** >> **0** >> **0**) for a new starting point.

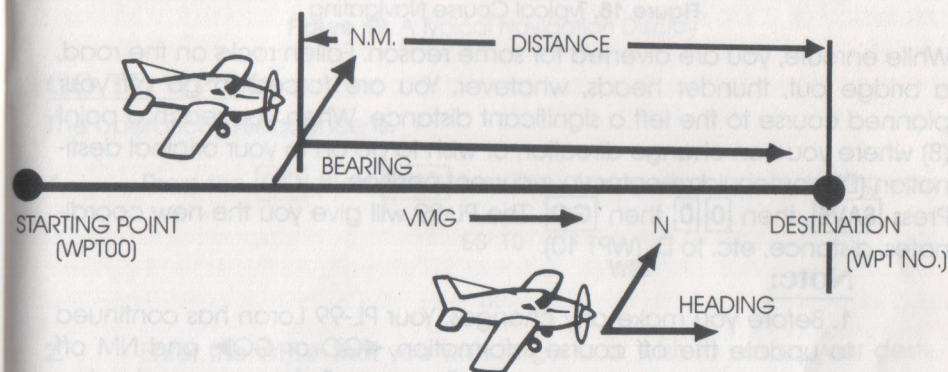


Figure 17. Navigation Terms Illustrated

Whenever you change the Waypoint while in the navigational mode, your loran will then store your current position in its memory location (00) and compute a new course line to the waypoint selected. When we use the expression "navigation mode," we mean that navigational data is being displayed; that is SPEED, MAG, BRG, DISTANCE and TTG or COG. The PL-99 is

always making navigational calculations when in the READY condition, regardless of what the displays show.

EXAMPLE: Let's say you've set a course for yourself ... you wish to travel from point A (your home) to Point D (Waypoint 10).

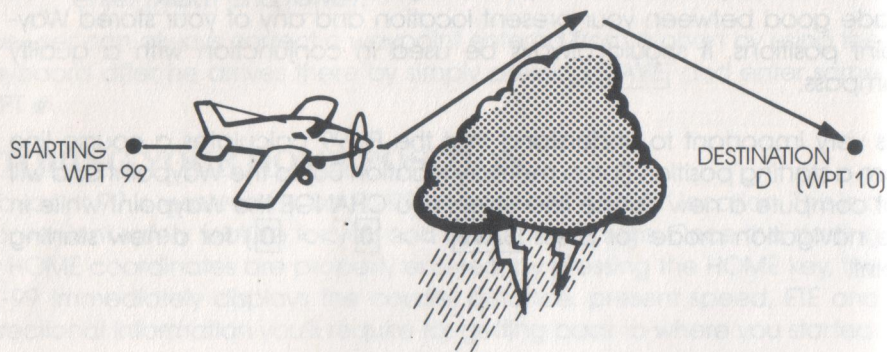


Figure 18. Typical Course Navigating

While enroute, you are diverted for some reason. Fallen rocks on the road, a bridge out, thunder heads, whatever. You are forced to go off your planned course to the left a significant distance. When you reach a point (B) where you can change direction or wish to go on to your original destination (D), you could re-enter your current position.

Press **SAVE**, then **00** then **GO**. The PL-99 will give you the new coordinates, distance, etc. to D. (WPT 10)

Note:

1. Before you make any changes. Your PL-99 Loran has continued to update the off course information **◀GO** or **GO▶** and NM off course display in the upper left corner. Before you make any changes you may wish to use this information to get back on course to your planned destination.

Warning

The navigation data displayed is never valid unless the "CHECK STATUS" indicator is off.

The PL-99 display is in the navigational mode if you press either the GO or HOME keys.

You can enter and exit the navigational mode at any time while the loran is operating. Even though the display is not in the navigational mode, the loran is still computing all the navigational information and will immediately display it when you return to the navigational display by pressing either the GO or HOME keys. When these keys are pressed, the PL-99 display shows CTE, TTG or COG, speed, magnetic bearing, distance to WPT. Cross track

error is displayed in 1/100th's of a nautical mile (refer to conversion table in the back of this book (resolves to 60 feet). The WPT coordinates in LAT/LON or loran time delays (TD's) are shown when LL is pushed. As you travel toward your destination WPT, the PL-99 continuously updates all these navigation parameters. Refer to the display figure below which illustrates a typical GO TO WPT# marine navigation situation. Our destination in the example is WPT# 10 and we are going 6.20 knots and we're 9.32 nautical miles away with a magnetic bearing of 293°. At our present speed, we have 1 hr and 30 minutes to go.

Go ▶ 6:30	Speed 6.20	WPT 10
M. BRG 293	DISTANCE 9.32	

Figure 19. A Typical Navigation Display

GO TO WPT#

The operational sequence is:

1. Press the **GO** then **CHG** key. The display responds by asking you:

GO TO
WPT
NO. — —

2. Enter the WPT# that you wish to go to or wish to use as your destination: (WPT# **10** Example)

3. The display then shows navigation information including Magnetic Bearing, Distance, Destination WPT, Speed and TTG. Or as illustrated in Figure 13. By pressing **GO** repeatedly you can alternate between TTG, COG and CTE.

4. If the coordinates for WPT#10 are incorrect or if you wish to change them, press **WPT 10 CHG**. The display responds with the choices:

L - L = 4
tds = 7

5. Press "4" for LAT/LON or "7" for TD's and enter your destination coordinates.

6. As soon as you make the last entry, the display will give your new coordinates information. Press **GO** to navigate.

7. Use your compass to steer the desired course (293°). (Figure 19)
8. Fine tune your direction with the help of the ◀GO or GO▶ arrows. Steer or change direction a slight amount as indicated by the arrow for small fractions of miles off course, and a larger amount for a greater distance off course. DO NOT hunt or chase arrows rapidly because you will overcompensate.

REMEMBER:

The navigation information takes a few seconds to be changed on the display.

COURSE DEVIATION INDICATOR

The PL-99 Loran includes an advanced Course Deviation Indicator (CDI) system which provides a directional or steering display as well as numerical Cross Track Error information. There are two parts to the PL-99 Course Deviation Indicator (CDI) system. When you understand this system you will be able to easily stay on course or quickly correct your steering to the proper course. The major parts of the CDI system are:

1. Course Indicator—This is the upper left corner of the display and consists of GO LEFT and GO RIGHT arrows. When you are more than ± 60 ft off, one of these steering arrows will be lit. The GO left and GO right arrows will be ON simultaneously when you're on course. If you change the display by pressing the **GO** button to TTG or COG, the steering arrows will continue to function but you won't know how far off course you are.
2. Cross Track Error—This is a 3 digit indicator just under the GO arrows which reads from 0.00NM OFF to 9.99NM OFF. The resolution of the 2nd digit is 600 feet and the resolution of the 3rd digit is 60 feet. That is, when you are 0.02NM OFF, it means you are 120 feet off and need to correct your course. Either the GO LEFT or GO RIGHT arrows will come on.

In actual practice, by using a compass and if you pay attention to both the NM OFF course display and GO LEFT and GO RIGHT indicators, you should be able to closely stay on course. Directional corrections should be small and you need to wait to see the effect of small changes on your displays.

COURSE OVER GROUND (COG)

The GO button toggles the upper lefthand indicator between crosstrack error (CTE), time to go (TTG) and COG (Course Over Ground). COG is the average track in degrees (the direction you have actually been traveling).

The direction is averaged over several minutes. Pressing the GO button does not change any other navigation function of the PL-99 Loran.

TIME TO GO (TTG)

Time To Go, or Estimated Time Enroute is a display of the time to reach the destination WPT at your present average speed. This number will not be valid unless you have been traveling at a fairly constant speed for several minutes. Your PL-99 will calculate up to 99:59 (99 hours, 59 minutes) anything longer will be displayed as 99:99.

ARRIVAL ALARM (CLOSE ALARM)

The PL-99 Loran is preprogrammed to sound its alarm and blink the alarm display if you are within 0.20 mile of your selected waypoint. This is the Loran's signal that you are close to the waypoint. To silence the alarm, press any key. To change the arrival alarm distance, or to see what arrival distance is being used, press FN 17. It allows you to enter and observe the distance simultaneously. Press the CLEAR key to get out of this mode.

The arrival alarm will also sound if you have missed the destination waypoint but have crossed an imaginary line going through the waypoint which is perpendicular to the line between WPT 00 and the destination, i.e. your "desired track."

SPEED AND VMG

Speed is the average rate at which you are traveling over the ground. It is displayed in knots or nautical miles per hour. (**BOATERS:** Loran speed is not the same as the speed you are doing through the water as is measured by the usual boat speedometer.) On a Loran, ground speed is averaged for several minutes. Therefore your speed indication is not an instantaneous measurement and it will not always agree with a speedometer and rarely with an airspeed indicator.

The average speed indication can be made to respond more quickly or average longer. This is done in special FUNC 31. When pressed, FUNC 31 displays the filter setting being used. Press CLR to change the filter. The display then shows:

SLO = 1
reG = 2
FAST = 3
AS IS = C

In most cases, the "reG" setting is best and it should not be changed unless you have a good reason to do so. Such as, when you are in an area of high

noise (poor SNR's) or when your crossing angles are very bad.

The PL-99 can display another type of speed called, "Velocity Made Good". This is the portion or vector of your speed that is "on-course"; another definition is the speed at which you are actually closing on your destination. The use of VMG or Course Speed is normally for use on tacking sailboats or under rough sea power boating situations where you must constantly steer to deal with sea or wind conditions. Or, while hiking and the trails or your path cause you to meander.

Special feature FN 34 permits the user to choose between GROUND SPEED and COURSE SPEED. Normally, i.e., in most cases you will want to stay in GROUND SPEED. COURSE SPEED is recommended for aircraft use.

PROBLEM ANALYSIS

General: The PL-99 Loran is a highly-developed combination of computer technology, navigation software, advanced mechanical design, and loran receiver art. It performs thousands of calculations per second and is a highly repeatable and generally reliable device. Despite what it does and the complexity of the internal circuits and software, nearly 80% of all loran failures are the results of user error, improper installation or poor connections. Very few electronic failures ever occur in modern loran sets. Therefore, we strongly urge users to carefully read the Operation Manual and check first for the most basic and detectable sources of failure such as: power connections, ground integrity, the antenna, antenna connector, power source voltage level, outside electrical interference and operational procedures.

In the event of difficulty and after checking as far as you are able, we recommend you call Loran Customer Service at Ray Jefferson, 215-487-2800 for further consultation and assistance. Have as much information written down at that time as you can so that we can be effective in helping to assess the problem. The most common problems observed and the explanation and remedy for them are:

WON'T TURN ON

When you first purchase and attempt to use your new PL-99, it probably will not turn ON or if it does, it may indicate LO BATT. *This is normal.* NiCad batteries will slowly self-discharge in storage. Connect the PL-99 to a live 12VDC source or use the 115VAC wall charger to charge the batteries. The batteries should be charged for a minimum of 4 hours. See section *Battery Care*.

NO TURN ON MESSAGE

This is usually a power problem. Is the internal battery charged? Refer to the *Battery Care* section. If using a 12 volt power source, check to see that voltage is present at the connector end of the 12 VDC power cable. If no voltage is present at the connector check your fuse and/or battery power source connections.

CHECK STATUS INDICATIONS

If your set seems to work but the CHECK STATUS indicator flashes ON and OFF frequently or repeatedly, you have either a reception or interference problem. Check your Status and if you have poor SNR numbers even away from interfering obstacles; tall buildings, dense woods, boat masts, there are two probable causes: poor grounding or electrical interference. Call Ray Jefferson for advice after doing what you can to check for bad grounding or electrical interference. Continue reading the remainder of this section.

REPEATS SEARCH SEQUENCE

If you are not getting signals to the receiver, the most likely cause is a bad coaxial connection from the antenna coupler or an open or shorted antenna. If you can, obtain another antenna coupler or telescopic antenna (you might even want to have a spare) and try it. Turn everything else in your area OFF and try to receive signals with the spare antenna. Or, you may be in a bad location. Move to a different position. If your PL-99 will not lock-in after these tests, call Ray Jefferson for further advice and direction.

MARGINAL OPERATION

Electrical interference and bad grounding are usually the cause if you are in a good loran reception area. You may also have the antenna installed improperly so that it is being shielded or obstructed. If the application is the problem, you must determine how to correct it because replacing the loran set will not cure the problem. Continue reading this section or call Ray Jefferson for assistance.

INTERFERENCE AND GROUNDING

For best results, the PL-99 Loran ground cable should be connected to a good ground such as a large metal object which is in contact with the water or the earth, to the engine, a keel bolt, or a grounded bonding system. A good ground is usually as important as antenna placement because it provides a part of the antenna system. (Refer to *GROUNDING* p. 22 and *WHERE THE PL-99 WILL WORK* p. 16.) A good ground will help to minimize the affects of electrical noise and improve the receiver's ability to track weak loran signals. If you experience signal reception problems, the location of the antenna and poor ground connections could well be the cause. The next most likely problem is electrical interference.

Although your PL-99 includes five notch filters designed to remove many of the known sources of interference, there are many other sources which can still cause significant errors in your loran receiver's ability to provide accurate positions.

Boat electrical noise, automobile or aircraft engine noise, and electrical interference can be difficult problems to solve, and for particularly troublesome situations, you may need the help of an experienced electronics technician. A line filter and/or a loran alternator filter sold by marine and other electronics stores is highly recommended. A 20,000 mfd, 50 V computer grade electrolytic capacitor connected across the 12 VDC supply positive and negative busses is also usually helpful. (Be certain to observe the polarity (+ and -) on the capacitor.) These are available at most electronics dealers.

The most common sources of electrical "noise" are your engine's alternator, TV sets (including portable TV's), fluorescent lights, video depth sounders and radars. If you must run any of this equipment while your loran is on, you should take care to confirm all navigational information since the accuracy of your loran readings may well be compromised.

The PL-99 includes an easy to use Signal-To-Noise Ratio Status display (displayed when STATUS button is pressed) which can be used to help identify and then correct the source or sources of interference. (See Page 53 for GRI status discussion).

First, get the PL-99 operating in a READY condition without your engine or other electrical items running. Then turn on other items one at a time, while observing the effect (if any) on the PL-99 signal status display, to identify which items are causing the problems. Keep your loran antenna and cables as far away as possible from depth sounders, bilge pumps, fluorescent lights, refrigerators, T.V. sets, etc. It sometimes requires a lot of technical "detective" work to determine where the source of the problems are. A good rule is "whenever you are making critical navigation measurements and decisions, turn OFF all unnecessary equipment."

When using the PL-99 as a fully portable device, your hand is the system's ground. If you want to put the PL-99 somewhere rather than hold it, it is best to place it upright on a metal object, such as a car. If possible, try to use the ground wire connected to some metallic object.

INCORRECT LAT/LON DISPLAYS

There are several kinds of LAT/LON errors and you must understand the reason for these and how to interpret whether your PL-99 Loran has a problem or if the conditions are causing incorrect displays. You can expect to have minor to large errors in congested harbors full of sailboat masts, under or near large bridges, in heavy industrial areas in buildings along estuaries and near radio broadcast stations. You will also get ASF errors along coastlines which have cliffs or nearby mountain ranges and in coves and other areas of vertical topography. Dense vegetation, especially tall trees, tend to weaken loran signals. Move to a clearing or near a lake.

The best place to check for LAT/LON errors is at sea or in the air, on open land or a stream where you are away from error-inducing factors and can reference to a known position such as a VOR or navigation buoy. There will still be some absolute accuracy error (See Page 15), but this will typically be 1/4 mile in average loran coverage areas. You may use the location of a navigation buoy to enter an ASF correction (See Page 55) to obtain correlation in that vicinity between your PL-99's LAT/LON or TD display and the

chart. Never rely on hearsay from other boaters, pilots or outdoorsman; learn how to interpret and correct your own LAT/LON information.

If you experience frequent (that is almost ALWAYS) LAT/LON errors of more than 1/4 to 1 mile, the problem is probably interference, poor antenna placement or inadequate grounding. You may need the help of an Electronic Technician to evaluate and improve your installation. If you experience occasional 2-5 mile errors, it could be that you are in a loran fringe area, or are operating on or near a BASELINE EXTENSION (that is the imaginary line between a loran master and secondary station and "extending" to the opposite side of the station, e.g. off Nantucket or Jupiter, Florida). Usually baseline extensions are labeled on charts. The error can be so bad that you cannot determine which side of the line you are on. This is an inherent limitation of the Loran-C System and has nothing to do with the performance of your loran set.

Finally, if you determine that your set ALWAYS gives an error of + 10 microseconds even at sea, on open land, or in the air, then there is almost certainly a problem with your set and it should be returned to Ray Jefferson for analysis and repair after calling the Loran Customer Service Department.

DO I HAVE SIGNALS?

This may be a valid question when you turn on your PL-99 for the first time or if the SEARCH routine repeats and you fail to achieve a signal lock. Ruling out extreme interference, there are only two typical explanations for absence of signals. One is that there are truly no detectable signals in the air (no Loran coverage, like in Australia); and the other is that there are no loran signals coming to the antenna or from the Remote Antenna Coupler to the PL-99. This means the antenna coupler has failed, perhaps due to being in the proximate area of lightning or very high electromagnetic radiation; or that there is a BNC connector problem; or the loran signals are being shielded. The best way to determine this is to have a spare or borrowed antenna coupler and try it or by moving to another area. Antenna couplers, although they include some input circuit protection, can be destroyed by lightning. It does not have to be a direct hit since the electrical field in the vicinity of a lightning strike can be very high. Antenna couplers are not expensive and if you use and depend on your loran frequently, having a spare antenna coupler may be a wise investment. You should also carry one or more spare telescopic antennas if you frequently use the PL-99 as a fully portable device.

The answer to whether you have signals or not is in the ability of your set to give an MWXYZ display when the STATUS key is pressed (See page 29). It may take from 2 to 4 minutes to complete the search, acquisition and lock routine. Your GRI status will start with ccccc (the last two "c's" will be absent if there are no Y or Z secondaries in your loran chain). The "c's" will gradually

be replaced with SNR (signal-to-noise ratio) numbers which can vary from 0 to 9. A small "o" means there is no signal and a small "b" means the station is temporarily not usable. In most loran areas you will get at least 2 or 3 stations with SNR's of 7, 8 or 9 and the other stations at 5 or above. If you have three stations with SNR's of 5 or better, you can expect the CHECK STATUS indication to go off and you can then depend on the loran information.

Another method of using the integral signal analyzing capabilities of the PL-99 Loran is explained in the next subsection. The principle means of signal presence verification is your STATUS display. It shows you the GRI you are attempting to use (bottom line) and the relative SNR numbers for each of the stations in the chain starting with the Master Station and the following in order with the W, X, Y and Z Secondary Stations on the top line.

RESTART AND SNR INTERPRETATION

Occasionally you may wish to restart or reset the PL-99. This may be because you have moved more than 50 miles from where the unit was last turned OFF, have gone to a different GRI or you suspect some problem and want to reset the unit with a new approximate position seed.

For a complete RESTART (or COLD start) use the FN key and enter 7 and 5 (FN 75). The display will ask you if you want to do a LAT/LON start or a GRI start. You will be in the AUTOMATIC mode if you select LAT/LON and enter your present position or approximate location coordinates. If you choose GRI, you will be in the NOT AUTOMATIC mode and it is up to you to determine which stations you wish to use for navigation. Normally, you would select LAT/LON, enter your position and wait a few minutes for search, acquisition and lock. These procedures do not affect any waypoint data stored in memory.

For a faster restart, press FN 7 9. This accomplishes a restart from your last calculated or input position. While both FN 75 and 79 are effective restart procedures, FN 75 should be the preferred method if you have moved or changed GRI's since the last turn OFF of the set.

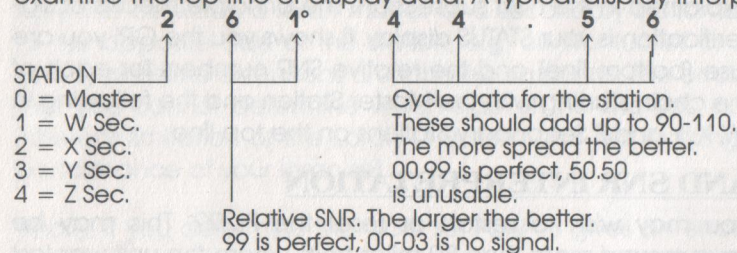
To do a detailed SNR interpretation as when selecting the best antenna position or when analyzing noise interference from other equipment, turn everything on the boat, vehicle or aircraft OFF except the PL-99 Loran. Wait for the CHECK STATUS indication to go off and select the special FN code

for the weaker station or one whose GRI status is no less than 4 or 5.

	FN # CODE TABLE				
GRI status	9	8	5	7	6 (example)
Station Letter	M	W	X	Y	Z
FN code	40	41	42	43	44

(all five stations are not present on all GRI's)

In the above example, we would select FN 42 because the X secondary has the poorest (smallest) SNR number in the GRI display. Press **FN 4 2** and examine the top line of display data. A typical display interpretation is:



The bottom line of data and the information to the right are more technical and of little benefit to the average loran user.

To use the top line data, if the antenna is moved, the SNR and cycle data numbers may get better or worse. You can observe the effects by turning ON a T.V., video fishfinder, or other equipment. You can observe whether moving the ground connection point helps or hinders performance, and you can determine if a line filter and/or a loran alternator filter improves performance. The FN 40 through 44 displays are truly built-in performance analysis instruments which can aid you in obtaining the best loran performance for your installation. With some trial and error and using the SNR indications, you can optimize any kind of installation or situation.

SPECIAL FUNCTIONS

General: Your Ray Jefferson PL-99 is a full-feature loran receiver and navigation computer which performs all of the expected loran functions. In addition, there are many special functions (FN) or calculations the user can elect to use. These are accessed and initiated by means of the FN key. There are explanations on these subjects beginning on P. 60. In addition, loran users should consider purchasing the U.S. Coast Guard Loran-C User Handbook, and any of several excellent textbooks on loran navigation. These publications should help you become more familiar with loran theory and application principles.

ASF CORRECTIONS EXPLAINED

Since radio signals do not travel at constant speeds relative to the average surface of the earth the loran LAT/LON positions displayed by the PL-99 Loran are always slightly in error. This is due to the varied terrain the signals must travel over before they reach your location on land or over the water. The errors are also caused by intervening land-water pathways and other physical reasons. These speed variations produce errors which can be corrected; however, the corrections are usually of little consequence to the navigator since the errors remain fairly constant; and, if you are using the PL-99 to return to places you've already visited, there is no need for corrections because of loran's very good repeatability.

If you know your exact position or wish to correlate your PL-99 with a Marine Chart, you can enter an ASF Correction. If you are at a chart reference, for example a buoy, airfield, VOR or other navigation aid, enter the coordinates of that point in your set after pressing **FN 05**. Remember, all charts have their own errors and inaccuracies that may vary from one part of the chart to another. Generally, ASF Corrections will only be valid for relatively small areas and do nothing to improve the repeatability of the PL-99 Loran. We recommend that you use ASF Corrections with **CAUTION** and remember to cancel ASF Corrections when you move more than 10 miles. The PL-99 has an ASF indicator on the FN 04 to remind you that you have entered an ASF Correction. Use FN 06 to clear ASF factor.

MAGNETIC VARIATION EXPLAINED

The PL-99 Loran automatically corrects its internal computations to show navigation data in terms of Magnetic North. Therefore, the PL-99's directional reading should match closely with your vehicle, aircraft or boat's properly installed and compensated compass. See functions FN 07, 08, 09 and 10 on Page 61.

ROUTING WAYPOINTS

Route is the route selection key. The PL-99 Loran stores up to 10 individual routes of 9 waypoints each and these can be run consecutively for a total route capacity of 90 waypoints. Routing seems somewhat complex at first, but with practice you will quickly master this technique. Before we get started setting up points in our route, make sure that you have programmed your waypoints in memory.

It's advisable at this time that you use a scratch pad if you plan to use more than one route. With all your waypoints and routes outlined as a reference, you can easily plan your routing.

TO SET UP A ROUTE

PRESS **[ROUTE]**, the display will indicate:

route

no. _

Enter a route no. (0 to 9). For example: enter no. **[0]**. The display will indicate

USE = 1

DISPL = 4

PRESS **[4]**. This will display what WPT # is located in PT. 1.

For example:

PT 1 IS

WPT 15

done = 4

If you wish to change WPT 15 assigned to PT. 1, PRESS **[CHG]** and enter the new WPT # for PT. 1. For example: Let's ENTER WPT **[10]**. Your PL-99 will display:

PT 1 IS

WPT 10

(WPT 10 is now your new WPT for PT. 1)

done = 4

(Note: DON'T press 4 until all your WPT's are entered)

To continue assigning WPT's in your route, PRESS **[NEXT]**. This will display what WPT # is located in PT. 2. For example:

PT 2 IS

WPT 20

done = 4

If you wish to change WPT 20 assigned to PT. 2 PRESS **[CHG]** enter your new WPT # for PT. 2. For example: Let's ENTER WPT **[25]**. Your PL-99 will display:

PT 2 IS

WPT 25

(WPT 25 is now your new WPT for PT. 2)

done = 4

(Note: DON'T press 4 until all your WPT's are entered)

You may continue to PRESS **[NEXT]** then **[CHG]** to enter your new WPT #'s for PTS. 3 thru 9 respectively as described above for PTS. 1 and 2. If you don't have to change your WPT # in an assigned PT. # PRESS **[NEXT]** to advance to the next PT. #. PRESS **[4]** when done, the above will be stored in memory for your routing.

If you wish to verify or review WPT's in your route PRESS **[4]** to display then PRESS **[NEXT]** repeatedly for each point. PRESS **[CLR]** twice, wait about 4 seconds to return to your present position.

TO USE A ROUTE

PRESS **[RTE]** (Enter Route # 0 thru 9) PRESS **[1]** to use. The PL-99 merely starts at the first routed waypoint (PT. 1) which you have stored in that route number. You can press **[NEXT]** to skip a waypoint, in a route or **[PREV]** to look back at a passed waypoint in a route.

You must set alarm distance for best waypoint switching (See FN17)

NOTE: Waypoint switches to next waypoint at alarm set distance.

DATA OUTPUT

The 12VDC power connector on the rear panel of the PL-99 includes a serial data output interface which can provide loran data to a marine autopilot, or track plotter, or a number of video fishfinders and graphic sonars. The serial data is in NMEA/0183 format and is transmitted continuously.

The NMEA/0183 data is transmitted at 4800 baud and is intended to work into an opto-isolator requiring 8 to 10 MA. When connected to a compatible fishfinder, loran navigation information will automatically appear when the fishfinder is using the loran menu. All pertinent navigation information plus track plotting can be displayed on some fishfinders. Your marine electronic dealer or technician can advise you whether various fishfinders are designed to receive and display loran information and if they will work with your PL-99 Loran. The data output is available only when the power/output cable assembly is being used, that is, when **the unit** is operating from a 12VDC source.

When used with a marine autopilot, the loran information will command the autopilot to steer the boat to the next waypoint. To use the data, the interconnections are shown in Figure 20:

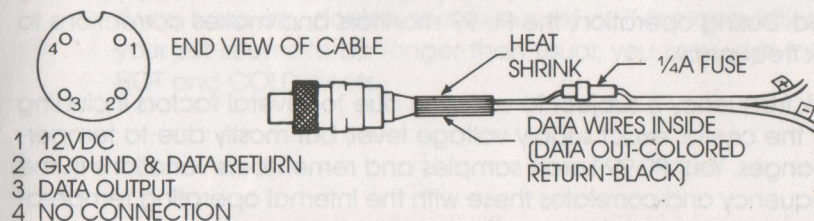


Figure 20. Power/Data Output Cable Assembly

Note:

Each time the unit is switched off the data output function recycles itself to the OFF mode.

The data output must be turned ON by the operator using Special Function FN 19. This is because the data output may cause a slight amount of interference to Marine VHF Radios. See FN 19 page 61.

TIMING (STOP WATCH, CLOCK)

The PL-99 Loran has three independent timers and a clock. When you select timer functions (FN 93 or 95), the timer number is shown in the lower display; "1" is the first Elapsed Time Counter, "2" is the second Elapsed Time Counter.

After the Time To Go Timer's (TTG) hours and minutes are set with FN 90, it will begin counting down to zero. When TTG reaches zero, it resets itself to 52:20.15 and starts counting down again from that time. FN 91 displays the time remaining. If you have gone past the original TTG setting subtract the FN 91 time from 52:20.15 to observe how far past your original TTG you have gone. In most applications TTG is set for relatively short periods of time. Timers 1 and 2 can be reset to zero time with FN 93 and 95, they then automatically begin counting up from your reset time. FN 93 and 95 display these counts. Press **CLR** to reset either to 00.00:00.

The 24-hour clock may be set to any time with FN 96. It starts when the minute's digit (i.e. 16:27) has been entered. The clock **must be reset** each time the PL-99 is turned off, when the GRI is changed, and at least once every 8 days when the PL-99 Loran is operated continuously. If the clock is not reset, it will start at 00:00.00 when the PL-99 is restarted. FN 97 displays the time of day.

The timers and clock may be displayed at any time without affecting navigation functions: they keep track of the time continuously. Accuracy of these timers and clock is approximately 1 second per 24 hours when the PL-99 is receiving signals continuously.

PL-99 INTERNAL CLOCK

The PL-99's digital circuitry and software system is referenced to an internal clock which is the crystal controlled oscillator. This clock frequency is compared with the Loran carrier frequency of 100KHz which is very precisely controlled. During operation, the PL-99 monitors and makes corrections to this clock frequency.

The clock frequency is subject to variation due to several factors including aging of the crystal, exact supply voltage level, but mostly due to temperature changes. Your PL-99 Loran samples and remembers variations in the clock frequency and correlates these with the internal operating temperature of the set.

Numbers relating to the internal temperature and clock frequency are displayed in FN 88. These are only relative or comparative numbers and ARE NOT actual temperature or actual clock frequency. The current temperature factor and actual clock frequency can be observed when you press FN 86 and FN 23 respectfully.

The PL-99 remembers the internal temperature factor and corresponding clock frequency to enable a faster signal search and acquisition time during initial turn on. The Loran set would work without this feature except that the initial search and acquisition time would be much longer.

In most applications, resets of the high and low temperature are not necessary. If, however, you are experiencing long acquisition times, you may wish to try a FN 87 temperature reset and a FN 84 clock offset entry.

If acquisition is taking a long time, (you can tell if there are many recycles of data in search), let the set run until it acquires and locks. This may take up to 10 minutes. Then do a special FN 23 and note the frequency differential from 8,000,000 Hz. For example, 8,000,053 means the differential is 053; 7,999,929 means the differential is -071. Write down this differential. Then do a special FN 84 and enter the differential into the PL-99's memory. To enter a positive differential, enter three digits, including zeroes. To enter a negative differential enter **E-** then the three digit differential.

Press FN 87 to do a HOT reset. Press 1 to reset; press 4 if you change your mind. Press FN 89 to do a COLD reset. Press 1 to reset; press 4 if you change your mind. REMEMBER, these resets should only be performed when the PL-99 is tracking Loran signals. DO NOT perform FN 87 when the PL-99 is in the simulator mode (FN 99) or at any other time when the set is not tracking.

Examples of situations calling for COLD or HOT resets are: If you usually travel in a semi-tropical area and decide one day to take your PL-99 Loran to the Great Lakes in February, you would want to do a COLD reset (FN 89) in the first morning you go out. Conversely, if you usually are in a mild area and go to an extremely hot place, you might want to do a HOT reset (FN 87) during the hottest part of the day. Occasional resetting of the HOT and COLD temperature factors will provide an accurate self-calibration.

Note:

If you have any doubts about your set or, if the acquisition time of your set seems to be longer than usual, you may wish to do both HOT and COLD resets.

SPECIAL FUNCTION (FN) OPERATIONS

The FN key allows you to use additional features of the PL-99 to help you navigate. Each feature is activated by pressing the FN key, waiting for the "Enter FN No. ____" display message, then entering the desired special calculation number. As you read the instructions for the numbered functions which follow, notice that this initial step is not repeated. The instructions pickup where "FN No. ____" appears on the screen.

The FN functions should be used only after carefully reading this section of the manual, since some of the FN functions if incorrectly executed could lead to the entry of erroneous data or inadvertent setting of the unit in the NOT AUTOMATIC mode. To preclude this type of error, the PL-99 includes a double verification feature in critical FN functions. On these functions, after entering the desired special function number, the PL-99 will ask you to verify. Press 1 to proceed with feature; cancel the procedure by pressing key 4. Non-critical functions do not have this double verification feature. Press any key to exit these non-critical functions.

FN 00

Enter 00 to turn the backlight ON or OFF. FN00 should only be used when the unit is attached to a 115 VAC or 12 VDC external power source. If you lose your Loran signals the backlight will automatically turn off. Use the backlight with the momentary panel button when operating on the internal battery.

FN 01

FN 01 offers the user a choice of either AUTOMATIC and NOT AUTOMATIC. In the AUTOMATIC mode, the PL-99 will always choose the most appropriate stations for you to use in navigating. In the NOT AUTOMATIC mode, you must choose the GRI and your choice of stations. The PL-99 will then use the TD's displayed and chosen with the POS key to calculate the LAT/LON. The PL-99 will not change your choice even if those TD's are unusable. To tell what mode you're in look at the right side of the display, "A" for AUTOMATIC, "nA" for NOT AUTOMATIC. This indicator is shown in the STATUS or GRI display mode.

FN 04

This special FN displays "ASF ENTERED" or "NO ASF ENTERED." It is merely an indicator and does not perform an actual function.

FN 05

This special function gives an entry prompt for you to enter your known exact position in LAT/LON. The PL-99 will continue to use this correction until you cancel it by using FN 06.

FN 06

Set the ASF corrections to zero. This should be done when you leave an area where ASF corrections are needed. Remember, ASF corrections are usually valid for small geographic areas.

FN 07

Displays the amount of magnetic correction (variation) being used in navigation calculations.

FN 08

By selecting FN 08 you are requesting that the PL-99 calculate and display the magnetic variation for your present position. This is the magnetic correction the set is using to determine your navigation information.

FN 09

Resets the magnetic correction to 0. This means navigation information being calculated is based on True North, not Magnetic North.

FN 10

This special function allows you to enter a magnetic correction of your choice. It should be done with CAUTION. It will use this correction until you change it or go back to the PL-99 internally determined value for your location. This is done with FN 08.

FN 12

This special function allows one to use a waypoint stored in memory as the starting point of navigation. Normally, WPT 00 is used unless you instruct the PL-99 to use some other waypoint using FN 12 and then entering the WPT#. Before pressing FN 12, display the waypoint you wish to go to. Then press FN 12 and enter that starting waypoint#.

FN 17

The top line shows the current arrival alarm distance and the bottom line permits you to enter a different value from .01 to .99. Press CLEAR to exit the special function.

FN 19

This special function turns the NMEA 0183 data output function ON or OFF. This is a toggle operation, press FN 19 once to send data, press FN 19 again to stop or turn OFF data transmission. This function automatically cycles to OFF when the unit is turned OFF. It will stay in this mode until turned on by the operator. Leave in OFF "position" unless you are actually using the output data to talk with another piece of equipment. This is also a power conservation measure.

FN 20

FN 20 allows you to self-test the entire LCD display. All digits will appear as 8's and annunciators will be shown on the display. Press any key to get out of FN 20.

FN 21

In this special function, the display will ask you to press "1" to display TD's resolved to 0.1, or to press "2" if you wish the TD display to be resolved to 0.01. The TD display will stay in whichever status you choose. With FN 21 you can change from one level of display resolution to another.

FN 23

This function allows you to check the internal crystal oscillator, which operates at a frequency of 8,000,000 Hz. When the PL-99 is receiving Loran signals, it calculates and displays its actual frequency to 1 cycle. The displayed value may range from 7,999,700 Hz to 8,000,300 Hz, but will probably be closer to 8,000,000 Hz most of the time.

FN 27

This is a convenient reference display function which calculates the bearing and distance between any two waypoints stored in memory. The display will first ask you to enter the START WPT# and the DEST WPT# and then automatically display the bearing and distance (12.3 NM in example) between them. See below for a typical display of this information. In this example we've asked the bearing and distance from WPT 09 to WPT 23. The display alternates:

139° FR	139° TO
WPT 09	WPT 23
12.3	12.3

FN 28

When using FN 28 you may convert a selected waypoints' location from LAT/LON to TDs. Two TD's will be displayed. Press the CHANGE/CLEAR button to display remaining TD's, which may be 1 or 2 additional TDs, depending on which GRI you are operating in.

FN's 29 AND 30

Occasionally, especially in the NOT AUTOMATIC mode, the PL-99 Loran might display a grossly incorrect LAT/LON (not a small error caused by transmission conditions.) To correct this, enter FN 30 (if in the NOT AUTOMATIC mode); try PRI first and then ALT. If not successful, try using different TD's. The best method is to use FN 29 and when the display shows "SEED LAT-LON", YES = 1, enter the waypoint close to your current position. Otherwise do a Cold Turn-On (FN 75) and enter the approximate LAT/LON of your current position.

FN 31

This feature allows you to display and change the Speed Filter setting used to compute the average speed display in the WPT, TIME TO GO and COG displays. Speed averaging ranges from fast (but jumpy) to regular to slow (but more stable.) The display shows which filter is in use. Press CHANGE and then select 1 = SLO, 2 = REG, 3 = FAST or C = AS IS, which means no change will occur (C is the CHG/CLR key).

FN 34

The PL-99 Loran normally expresses the speed shown in the navigation displays as Speed Over the Ground. As an alternative, you may instruct the PL-99 to display speed in terms of Velocity Made Good (VMG). VMG is the portion of your speed that is along your desired track (start point to destination), and is always less than your actual speed. FN 34 allows you to determine which speed mode is currently being used. VMG is indicated by "COURSE SPEED", Speed Over the Ground is indicated by "GROUND SPEED". Both displayed speeds are averaged for 3 to 5 minutes depending on the speed average selected by FN 31. Most users will want to use GROUND SPEED. COURSE SPEED is especially for sail boats and aircraft. The speed indicates VMG or closing speed on the desired waypoint regardless of course or bearing changes made enroute. Press 1 for COURSE SPEED and 4 for GROUND SPEED after entering FN no. 34.

FN 40

Pressing the STATUS key provides some information about signal strength and status. More detailed information for testing purposes is available by using functions FN 40 through FN 44. The TOP display line of each of these four functions shows which station the display data corresponds to and the status of that station.

The first digit indicates which station is being displayed as follows: 0 = master; 1 = W secondary; 2 = X secondary; 3 = Y secondary; and 4 = Z secondary.

The second two digits before the degree mark is the signal-to-noise (SNR) factor. It is not the actual SNR, but a relative number for comparison. A value of 99 is the highest measureable SNR and 00 is totally unusable. SNR's in the 90's should be expected for the strongest stations under good conditions. Weaker are usually in the 70's or 80's.

The next four digits XX.YY pertain to cycle point data quality. These are somewhat technical values and will vary widely depending on signal strength and conditions. They should add to between 95 and 105. Strong stations may sometimes be 00.99, which is theoretically ideal. Weaker stations may be closer to 40:60, and 50:50 is totally unusable. Refer back to Page 53 under the heading, "... SNR Interpretation."

The small digits in the normal WPT space count the number of GRI's since reset in 100's. It will stop at 20. The next three digits on the CTE bottom line are: 1st, 0 for strong stations and 4 for stations in background; 2nd signal status: 1 = Low SNR, 2 = cycle error, 4 = blink, 8 = searching and 0 = signal acquired and locked; 3rd is gain condition with 0 = low gain and 1 = high gain. The strongest stations may be in low gain in certain areas. The next and last four digits on the bottom line are technical numbers pertaining to skywave data and are of little use to the average navigator. They will be close to 50.50, but probably slightly different for each station in the chain.

Typical display:

STATION—098°
SNR—

20 . 80 **TOP DISPLAY LINE**
SIGNAL DATA

01—WPT digits. GRI's
divided by 100 since
cycle selection

STATUS—001°
GAIN—

51 . 56 **BOTTOM DISPLAY LINE**
SKYWAVE DATA

FN 41

Displays the W-secondary data (lowest TD value).

FN 42

Displays the X-secondary (second lowest TD value).

FN 43

Displays the Y-secondary signal data (third lowest TD value).

FN 44

Displays the Z-secondary signal data (highest TD value).

FN's 60 thru 64

These special calculations allow you to manually change the TD value from ± 10 to ± 90 microseconds. They should be used only by very experienced loran navigators since they can introduce large errors. However, they are useful under certain conditions for the experienced user.

Jumping any signal also locks that signal. When the Master is jumped, all TD's jump in the opposite direction. That is, if the Master is jumped $+ 10$, all secondaries will decrease $- 10$. When pressing FN 60 thru 64, you then enter 1 thru 9 in front of the 0 already on the screen. Press E/- if you want a negative (-) jump. To clear the jumps press FN 70. It will take the PL-99 about a minute or more to recover back to normal.

FN 60 Jump the Master

FN 61 Jump the W-secondary

FN 62 Jump the X-secondary

FN 63 Jump the Y-secondary

FN 64 Jump the Z-secondary

FN 70 Unlocks and clears all locked stations.

FN 71 thru 74

These special functions allow the user to enter individual ASF corrections as opposed to a general ASF correction (FN 06). These corrections should only be used by experienced loran navigators, so use caution. The entries will stay in the PL-99 until you clear them with FN 06 (cancels ASF corrections.) If you press CHANGE after initiating FN 71 thru 74, you can exit from these special functions.

To enter a correction form ± 0.1 ± 9.9 micro-second, press FN 71-74 and enter the first digit (units) and the second (tenths). The third line will show the ASF correction that was previously entered and being used. This will normally be 0.0 if you have never entered a correction or done a FUNC 06 reset. If you change your mind or decide to use a different value, just re-enter it. You may enter a positive or negative value on the bottom line. Press E/- if you want a negative correction. Then press CLR and your current position will appear.

Remember, FN 06 resets all ASF corrections to zero when you press "2" and you'll want to change or reset the corrections when you leave the area.

FN 71

Enter ASF correction for W-secondary, the lowest TD value.

FN 72

Enter ASF correction for X-secondary, the 2nd lowest TD value.

FN 73

Enter ASF correction for Y-secondary, the 2nd highest TD value.

FN 74

Enter ASF correction for Z-secondary, the highest TD value.

Note:

FN 06 resets all ASF corrections to zero.

FN 75

Note:

This function is especially important to persons who carry their PL-99 Lorans over distances greater than 50 miles before turning them on.

This is the Cold Turn-On feature used to completely reset the PL-99 Loran. **Everything** except for the waypoint data in memory which you have already entered, **is reset** to the factory-specified defaults. After using this reset, enter your initial start-up (or home) location from loran charts or from the Start-up Location Table in Appendix B. Also see page 53, "RESTART...".

FN 79

FN 79 restarts the PL-99 using current GRI or LAT/LON reading. Using GRI puts the unit into a non-auto mode. See FN 01.

FN 80

Displays software version in the PL-99 Loran.

FN 84

There is one additional special function which is primarily a factory alignment aid by which the clock oscillator frequency is stored in the PL-99's memory. The function is used in conjunction with Special Functions 86 through 89 and will seed or store the stabilized internal clock frequency offset. If FN 84 is called-up, the display will ask you to enter the last three digits of the clock frequency as displayed in FN's 23 and 86. Enter the three least significant (last) digits and a (-) sign first if the frequency is less than 8,000,000, e.g., 7,999,947 would be entered as -053. There is normally no need for the average user to use FN 84, unless signal acquisition is taking a long time.

FN 85

Resets standard time constant regular or fast. Regular is best. Pressing FN 85 scrolls this feature; i.e. by repeating this function you move from regular average to fast average and to regular average again. When turned OFF, the *Regular Average* will be used at the next turn on.

FN 86

Displays the current temperature factor and oscillator frequency.

FN 87

Permits resetting of the High Temperature factor. If the set is being subjected to higher temperatures than it has ever been operated in previously, PRESS YES = 1 if you want to reset. Read the discussion on page 58 *INTERNAL CLOCK* prior to performing a reset. The PL-99 **must be** operating and tracking a loran station for a valid reset.

FN 88

Displays the temperature factor and oscillator frequency history. The left side numbers indicate the Hi and Lo temperature factors which the PL-99 is remembering. The right side numbers are approximately the high and low oscillator frequencies expressed as Hertz (cycles) above or below 8,000,000 Hz. These were set at the time of manufacture, but they may be reset by the user. Refer to Page 58 "INTERNAL CLOCK".

FN 89

Permits resetting of the Cold Temperature factor. Reset only if you suspect the set is being exposed to much colder temperatures than it has previously been operated in.

FN 90

Sets and displays the down counter (Time To Go)

FN 91

Displays down (Time To Go) counter

FN 93

Displays the first elapsed time counter. Press CLR to reset to zero.

FN 95

Displays the second elapsed time counter. Press CLR to reset to zero.

FN 96

Sets and displays time of day (24 hour time). Must be reset after power down.

FN 97

Displays time of day. Must be reset after power down.

FN 98

The Anchor Watch reports when your boat has drifted outside an imaginary circle surrounding your anchor waypoint. When you select FN 98, the PL-99 first asks you to select an anchor waypoint; the spot where you dropped anchor. You can use any waypoint with this feature—just save the spot when you release the anchor by pressing **SAVE** and selecting a waypoint number. Any coordinates stored for this WPT # are erased—see "NOTE" page 41. Your PL-99 Loran asks for an "anchor distance." Enter any distance between 0.02 and 0.99 nautical miles. If your boat drifts outside this radius the alarm will sound. Press CLR to exit this function. If however, you press CLR while the alarm is sounding you will only silence the alarm.

FN 99

There is a special function, FN 99, that puts the PL-99 Loran into a simulation mode. This function is intended for sales demonstration purposes only. It is of little use to the average user. In this mode you will be "traveling" off the East Coast of Florida. FN 99 can be entered without use of an antenna coupler or signal by simply pressing **ON**, **E/-**, then **FN** and **9 9**. The unit responds by asking self trac YES = 1 no = 4.

The user is **WARNED** that if he does use FN 99, he must do a COLD RESTART (FN 75) to restore normal operation.

SUMMARY, PL-99 SPECIAL FUNCTIONS (FN)

Bold face type indicates more frequently used functions

- 00 **TOGGLE LIGHT ON/OFF**
- 01 **TOGGLE AUTOMATIC/MANUAL**
- 04 DISPLAYS "ASF ENTERED" OR "NO ASF ENTERED"
- 05 CORRECTION OF POSITION TO A KNOWN POINT (CALCULATES ASF'S)
- 06 SETS ALL ASF'S TO 0
- 07 DISPLAYS AMOUNT OF MAGNETIC CORRECTION USED (VARIATION)
- 08 COMPUTES (AND USES) MAGNETIC VARIATION FOR PRESENT POSITION
- 09 SETS USED MAGNETIC CORRECTION TO 0
- 10 ALLOWS ENTRY OF ANY AMOUNT OF MAGNETIC CORRECTION
- 12 ALLOWS SELECTION OF ANY WAYPOINT AS START OF NAVIGATION
- 17 **DISPLAYS CURRENT VALUE FOR ARRIVAL ALARM DISTANCE**
- 19 TURNS INTERFACE DATA OUTPUT ON OR OFF
- 20 LIGHTS ALL SEGMENTS (SELF-TEST LCD DISPLAY)
- 21 ALLOWS SELECTION OF TD DISPLAY TO 0.1 OR 0.01
- 23 DISPLAYS RECEIVER OSCILLATOR FREQUENCY
- 27 **CALCULATES BEARING AND DISTANCE BETWEEN TWO WAYPOINTS**
- 28 CONVERT A WPT FROM LAT/LON TO TDS
- 29 SEEDS LAT/LON CONVERTER WITH ANY GIVEN WAYPOINT
- 30 ALLOWS SELECTION OF A PRIMARY OR ALTERNATE POSITION FOR L/L
- 31 ENTER A NEW TIME CONSTANT FOR SPEED AVERAGING
- 34 **TOGGLE COURSE OR GROUND SPEED**
- 40 MASTER STATION DATA
- 41 W-SECONDARY DATA
- 42 X-SECONDARY DATA
- 43 Y-SECONDARY DATA
- 44 Z-SECONDARY DATA
- 60 JUMP AND LOCK MASTER STATION
- 61 JUMP AND LOCK W-SECONDARY
- 62 JUMP AND LOCK X-SECONDARY
- 63 JUMP AND LOCK Y-SECONDARY
- 64 JUMP AND LOCK Z-SECONDARY
- 70 CLEARS CYCLE ERRORS
- 71 DISPLAY AND CHANGE VALUE OF W ASF
- 72 DISPLAY AND CHANGE VALUE OF X ASF
- 73 DISPLAY AND CHANGE VALUE OF Y ASF
- 74 DISPLAY AND CHANGE VALUE OF Z ASF
- 75 **KILL SAVED START-UP POSITION AND RESTART (COLD START)**
- 79 RESTART FROM LAST CALCULATED OR INPUT POSITION
- 80 DISPLAYS SOFTWARE VERSION IN USE

- 84 RESET CLOCK OSC, FREQ TO ZERO
- 85 RESET STANDARD TIME CONSTANT
- 86 DISPLAYS TEMPERATURE FACTOR AND OSCILLATOR FREQUENCY
- 87 OSCILLATOR (HIGH) TEMPERATURE FACTOR RESET
- 88 DISPLAYS TEMPERATURE FACTOR AND OSCILLATOR HISTORY
- 89 COLD TEMPERATURE RESET
- 90 **SET AND DISPLAY DOWN COUNTER**
- 91 **DISPLAY DOWN COUNTER**
- 93 **DISPLAY FIRST ELAPSED TIME COUNTER OR RESET**
- 95 **DISPLAY SECOND ELAPSED TIME COUNTER OR RESET**
- 96 **SET AND DISPLAY TIME OF DAY**
- 97 **DISPLAY TIME OF DAY**
- 98 **ANCHOR WATCH FUNCTION**
- 99 SIMULATOR MODE FOR SALES DEMONSTRATION

SOME COMMON LORAN QUESTIONS

- Q. Will my loran work anyplace? Mexico, South America, Australia and Canada?
- A. No. Loran coverage is only in the Northern Hemisphere and extends only to the northern parts of Mexico. The East and West Coasts of Canada have loran coverage, as do portions of Europe and Asia and The Mediterranean.
- Q. Where is the best spot for my Antenna Coupler?
- A. Usually high and in the clear; away from all other metal objects and other antennas. See installing the PL-99 Page 20.
- Q. What is my boat's voltage supposed to be?
- A. The normal boat electrical system is 13.6 VDC and is called a 12 volt system. When the engine is OFF, it will drop near 12 VDC and be higher during running. The PL-99 is designed to operate from voltage supplies from 11 to 16 VDC.
- Q. How close can I get back to a fishing hole?
- A. Generally in good loran areas, if you are careful, you can return to within ± 25 feet.
- Q. My loran doesn't work very well when I turn on my portable T.V. How come?
- A. Television sets and some depth flashers, fishfinders and even VHF radios can cause loran interference. See Page 53.
- Q. Why is my set giving the wrong GRI or station?
- A. You are probably in an overlap area. See Page 38 for further explanation.
- Q. What does the Antenna Coupler do?
- A. It permits you to install the Loran-C antenna remotely, away from the PL-99. This is especially convenient on boats, RV's and other kinds of vehicles.
- Q. Can my PL-99 Loran run a marine autopilot?
- A. Yes. Your PL-99 has a 2-wire NMEA/0183 output which can interface with a marine autopilot when being powered externally by 12 VDC. See DATA OUTPUT on Page 57.

- Q.** Will I lose my WAYPOINT memory when LO BATT comes on?
- A.** No. Your waypoint memory is retained even if LO BATT comes on, or during charging, and even if the internal battery charge level is so low that the PL-99 turns itself off.
- Q.** How about marine track plotters and fishfinders, some of them have loran connections?
- A.** The PL-99 Loran will communicate with many fishfinders and track plotters. A marine Electronics Dealer or Technician should be able to tell you which fishfinders and other marine equipment your PL-99 is compatible with.
- Q.** Does temperature affect my loran?
- A.** The PL-99 Loran should be kept away from direct sunlight and rain or snow. It can operate at as low as -10°C or as high as 60°C . This is about 16°F to 150°F . The display becomes slow to respond in cold temperatures.
- Q.** What is all this I hear about repeatability and accuracy? Aren't they the same thing?
- A.** No. Repeatability is the ability to return very accurately to someplace you've been. Accuracy refers to correlation to charts. See Page **15** for more discussion.
- Q.** Will a C.B. or automobile radio antenna work with my PL-99?
- A.** No and Yes. C.B. antennas should not be used, but an automobile radio antenna can be used. See Page **25** for more discussion.
- Q.** Do I have to use a ground connection?
- A.** Your PL-99 is grounded through the back plate and your body when used as a hand-held. You should make a point of having your hand in direct contact with this plate when using the unit as a portable. A ground is not always necessary, but a ground will always improve reception. The wire ground should be used when possible.

- Q.** Does the antenna have to be rigid and perfectly vertical?
- A.** No. A wire can be used as an antenna. It should be as vertical as possible.
- Q.** Why can't I replace my own batteries?
- A.** A special battery pack is used which is not a store "off-the-shelf" item. With proper and reasonable care, the battery pack will last several years. If the battery ever needs replacing, such as when it will not accept a charge, the PL-99 should be returned to Ray Jefferson.

NAVIGATION

This involves planning and controlling the course and position of a boat, an airplane or a backpacker, anyone traveling from one known location to another. Loran works in conjunction with charts or maps as an aid to navigation. The loran receiver provides data on location, course to destination, speed, distance, as well as other important navigational information which is discussed elsewhere in this manual. (Speed in knots; Distance in nautical miles.)

RANGE

The distance to your waypoint.

RATE

Same as GRI; the rate at which the loran signals repeat.

STATUS/CHECK STATUS

The PL-99 tells you when it is not ready with the CHECK STATUS annunciator. When CHECK STATUS shows, use the position or the navigation data with extreme caution since it probably is not correct. Press STATUS to observe the SNR's of the stations in the chain.

RHUMB LINE

True heading maintained without direction change from starting point to destination. The PL-99 makes calculations based on Great Circle angles. The shortest distance between 2 points on the surface of a sphere is the Great Circle Route.

SNR (SIGNAL-TO-NOISE RATIO)

The ratio of loran signal strength level to background noise level, including noise generated on your boat. In most cases Loran-C receivers are designed to operate with an SNR of 1:3 or stronger.

SPEED

Your PL-99's speed readout is an average of the speed you are doing over the ground. For marine navigators, this will be different from the speed you are doing through the water. See COG. Because the PL-99 is averaging your speed, it is slower to respond than a typical speedometer.

STATUTE MILES

5,280 feet; multiply statute miles by .87 to get an approximation of nautical miles. See Conversion Table, Appendix C.

TD

Time Delay; the PL-99 Loran measures the TD's between the loran signals (the signals from each station are received sequentially—master first, then the W-secondary, etc.); these TD's are in millionths of a second and their values plotted on the loran charts.

VMG

Velocity Made Good; the portion of your speed that is on-course.

WAYPOINT

A point along the way; the places where you want to go; the waypoint you are heading toward is also called your destination.

APPENDIX B—START UP LOCATIONS

In normal operation, your PL-99 Loran remembers all of your waypoints and where it was when last shut off. The PL-99 is shipped to you with all data (including start-up information and waypoints) erased or in a random condition. Therefore, the first time you turn on the PL-99, or if you do a Cold Turn-on (FN75), you must enter a Turn-on location in LAT/LON or GRI.

The memory is maintained by the internal Ni Cad battery which has a life expectancy of several years from date of manufacture. If the battery is ever replaced, memory data will be lost. However, the memory data will not be lost even if the internal battery is severely discharged. A severely discharged battery can be recharged.

Use the following table to find the location nearest you and enter these LAT/LON numbers exactly as they appear. The PL-99 will use the start-up LAT/LON for calculation and store information for the next time you turn on the receiver. The PL-99 will automatically start itself thereafter if you have not moved more than 50 miles since turn-off. If you have moved more than 50 miles do a cold restart. See FN 75 page 66.

Note:

You will notice that TD's are not listed for some states. The reason is that new chains are not on line as of this printing consequently TD's are not yet available. Two new Loran C chains are expected to be operational by mid-1991 while an existing chain is going to be expanded for general coverage during the same period.

The recommended chains in some localities will change due to expansion of the Loran C system. Therefore, the start-up information in this manual is dated and subject to change. In some cases, more than one chain may service an area. Ray Jefferson has attempted to give you the most correct GRI and TD information available. Please observe the applicable footnotes at the end of this appendix.

Your PL-99, if operating in the areas of the new Loran C chains, will require new software to accommodate the new chains. You can contact Ray Jefferson at the location in the front of this book for further information.

	<u>LAT</u>	<u>LON</u>	<u>GRI/TD's</u>
<u>ALABAMA</u>			
Bayou La Batre	30 20.00	088 15.00	7980 12/29
Gulf Shores	30 15.00	087 40.00	7980 12/47
Mobile	30 40.00	088 00.00	7980 12/30
<u>ALASKA</u>¹			
Anchorage	61 00.00	149 00.00	7960 13/49
Barrow	72 00.00	157 00.00	7960 15/47
Fairbanks	64 00.00	148 00.00	7960 15/50
Ketchikan	56 00.00	132 00.00	7960 14/51
Wrangell	53 00.00	172 00.00	7960 11/45
Kodiak	57 30.00	153 00.00	9990 32/43
Nome	64 00.00	166 00.00	9990 23/49
<u>ARIZONA</u>²			
Phoenix	33 30.00	112 10.00	9610 —
Tucson	32 20.00	111 00.00	9610 —
Mt. Trumbull	36 40.00	113 20.00	9610 —
St. Johns	34 30.00	109 30.00	9610 —
<u>ARKANSAS</u>³			
Little Rock	34 40.00	092 20.00	7980 11/28
De Queen	34 10.00	094 25.00	7980 11/28
Blytheville	35 50.00	089 50.00	7980 11/28
<u>CALIFORNIA</u>			
Big Sur	36 10.00	121 45.00	9940 27/42
Bodega Bay	38 20.00	123 00.00	9940 15/43
Eureka	40 50.00	124 10.00	9940 14/27
Fort Bragg	39 30.00	123 50.00	9940 15/27
Half Moon Bay	37 30.00	122 25.00	9940 27/43
Long Beach	33 45.00	118 15.00	9940 28/41
Monterey	36 35.00	121 50.00	9940 27/42
Newport Beach	33 40.00	118 00.00	9940 28/40
Point Arena	38 50.00	123 40.00	9940 15/43
P. Conception	34 25.00	120 25.00	9940 27/41
Port Hueneme	34 10.00	110 10.00	9940 28/41
Redondo Beach	33 50.00	118 20.00	9940 28/41
San Diego	32 45.00	117 15.00	9940 28/40
San Francisco	37 50.00	122 25.00	9940 27/43
Santa Barbara	34 25.00	119 40.00	9940 28/41
Santa Monica	34 00.00	118 25.00	9940 28/41
Ventura	34 15.00	119 20.00	9940 28/41
See footnotes at the end of this section.			

<u>COLORADO²</u>	<u>LAT</u>	<u>LON</u>	<u>GRI/TD's</u>
Cortez	37 20.00	108 30.00	9610 —
Denver	39 40.00	104 50.00	9610 —
Pueblo	38 20.00	104 30.00	9610 —

CONNECTICUT

Bridgeport	41 10.00	073 10.00	9960 26/44
New Haven	41 15.00	072 55.00	9960 26/44
New London	41 20.00	072 05.00	9960 26/44

DELAWARE

Delaware Bay	39 00.00	075 20.00	9960 27/42
Rehoboth Beach	38 40.00	075 10.00	9960 27/42

FLORIDA

Apalachicola	29 45.00	085 00.00	7980 14/46
Boca Raton	26 20.00	080 00.00	7980 14/62
Cape Coral	26 35.00	082 00.00	7980 14/43
Clearwater	28 00.00	082 50.00	7980 14/44
Daytona Beach	29 15.00	081 00.00	7980 44/62
Fort Lauderdale	26 10.00	080 10.00	7980 14/43*
Hollywood	26 00.00	080 10.00	7980 14/43
Key Biscayne	25 40.00	080 10.00	7980 14/43
Key Largo	25 10.00	080 25.00	7980 14/43
Key West	25 30.00	081 50.00	7980 14/43
Miami	25 45.00	080 10.00	7980 14/43
Pensacola	30 25.00	081 15.00	7980 13/47
Port Richey	28 20.00	082 45.00	7980 14/44
Sarasota	27 20.00	082 30.00	7980 14/44
Tampa	27 55.00	082 30.00	7980 14/44
Titusville	28 40.00	080 40.00	7980 44/62
West Palm Beach	26 50.00	080 00.00	7980 14/62

*The 43 TD may be unusable near West Palm Beach.

GEORGIA

Brunswick	31 10.00	081 25.00	7980 45/61
Savannah	32 00.00	081 10.00	7980 45/61

HAWAII

Hilo	19 40.00	155 10.00	4990 11/37
Honolulu	21 20.00	157 30.00	4990 11/37
Lihue	22 00.00	159 20.00	4990 11/37

<u>IDAHO⁴</u>	<u>LAT</u>	<u>LON</u>	<u>GRI/TD's</u>
Sandpoint	48 30.00	116 30.00	8290 or 9610
Boise	43 30.00	116 20.00	8290 or 9610
Soda Spring	42 40.00	111 30.00	8290 or 9610

ILLINOIS

Chicago	41 50.00	087 35.00	8970 33/50
Evanston	42 00.00	087 45.00	8970 33/49
Waukegan	42 20.00	087 50.00	8970 33/49

INDIANA

Gary	41 30.00	087 15.00	8970 33/50
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IOWA

Sioux City	42 30.00	096 25.00	8970 33/47
Des Moines	41 35.00	093 40.00	8970 33/47
Burlington	40 80.00	091 10.00	8970 33/47
Forest City	43 20.00	093 40.00	8970 33/47

KANSAS⁵

Wichita	38 30.00	097 20.00	9610 16/49
Kansas City	39 10.00	094 40.00	9610 16/49
Coffeyville	37 00.00	095 35.00	9610 16/49
Garden City	37 50.00	100 50.00	9610 16/49

KENTUCKY³

Morehead	38 10.00	083 25.00	7980 12/62
Louisville	35 40.00	075 10.00	7980 12/62
Princeton	37 10.00	088 50.00	7980 12/62
Hickman	36 35.00	089 10.00	7980 12/62

LOUISIANA

Abbeville	29 55.00	092 05.00	7980 27/47*
Cameron	29 45.00	093 20.00	7980 26/46*
Morgan City	29 36.00	091 10.00	7980 11/27
New Iberia	30 00.00	091 50.00	7980 27/47*
New Orleans	30 00.00	090 00.00	7980 11/28

*The 11 TD is unusable close to the coast.

MAINE

Bar Harbor	44 20.00	068 15.00	9960 12/25
Millbridge	44 30.00	067 50.00	9960 12/25
Portland	43 40.00	070 20.00	9960 13/26

<u>MARYLAND</u>	<u>LAT</u>	<u>LON</u>	<u>GRI/TD's</u>
Annapolis	39 00.00	076 30.00	9960 27/42
Cambridge	38 35.00	076 05.00	9960 27/42
Crisfield	38 00.00	075 50.00	9960 27/42
Lexington Park	38 15.00	076 25.00	9960 27/42
Ocean City	38 20.00	075 05.00	9960 27/42

MASSACHUSETTS

Boston	42 20.00	071 00.00	9960 14/25
Falmouth	41 30.00	070 35.00	9960 25/43
Lynn	42 30.00	070 55.00	9960 13/25
New Bedford	41 40.00	070 55.00	9960 25/44
Provincetown	42 05.00	070 10.00	9960 13/25
Quincy	42 15.00	071 00.00	9960 14/25

MICHIGAN

Alpena	45 00.00	083 30.00	8970 30/48
Benton Harbor	42 05.00	086 35.00	8970 32/50
Detroit	42 20.00	083 00.00	8970 31/49
Gould City	46 10.00	085 45.00	8970 31/47
Holland	42 50.00	086 15.00	8970 32/49
Ludington	43 55.00	086 30.00	8970 32/48
Munising	46 25.00	086 35.00	8970 31/47
Muskegon	43 10.00	086 25.00	8970 32/49
Port Austin	44 00.00	083 00.00	8970 30/49
Port Huron	43 00.00	082 30.00	8970 30/49
Tawas City	44 20.00	083 25.00	8970 31/49
Whitefish Point	46 45.00	085 00.00	8970 31/47

MINNESOTA

Duluth	46 45.00	092 00.00	8970 32/45
Grand Marais	47 50.00	090 20.00	8970 32/45
Grand Potage	48 00.00	089 40.00	8970 31/45
Silver Bay	47 15.00	091 15.00	8970 32/45
Two Harbors	47 00.00	091 40.00	8970 32/45

MISSISSIPPI

Bay St. Louis	30 20.00	089 20.00	7980 11/29
Biloxi	30 25.00	088 55.00	7980 12/29
Gulfport	30 20.00	089 05.00	7980 12/29
Pascagoula	30 20.00	088 35.00	7980 12/29

MISSOURI

Maryville	40 40.00	094 50.00	8970 34/48
Carthage	37 10.00	094 20.00	8970 34/48
Dexter	36 40.00	089 55.00	8970 34/48
Palmyra	39 50.00	091 30.00	8970 34/48

MONTANA⁶

<u>LAT</u>	<u>LON</u>	<u>GRI/TD's</u>
Kalispell	48 20.00	114 20.00 8290 —
Anaconda	46 10.00	112 58.00 8290 —
Baker	46 25.00	104 10.00 8290 —
Plentywood	48 50.00	104 30.00 8290 —

NEBRASKA^{2,3,4}

Crawford	42 40.00	103 25.00 9610 or 8970
Sidney	41 10.00	102 59.00 9610 or 8970
Tecumseh	40 25.00	096 15.00 9610 or 8970
Hartington	42 35.00	097 15.00 9610 or 8970

NEVADA⁷

Wells	41 10.00	115 00.00 9940 16/43
Boulder City	36 00.00	114 50.00 9940 28/40
Lovelock	40 15.00	118 30.00 9940 16/43
Babbitt	38 30.00	118 40.00 9940 28/43

NEW HAMPSHIRE

Portsmouth	43 00.00	070 45.00 9960 13/26
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NEW JERSEY

Asbury Park	40 15.00	074 00.00 9960 26/43
Atlantic City	39 20.00	074 25.00 9960 26/43
Cape May	38 55.00	074 55.00 9960 27/42
Perth Amboy	40 30.00	074 15.00 9960 27/43
Sandy Hook	40 30.00	074 00.00 9960 27/43

NEW MEXICO²

Clayton	36 28.00	103 10.00 9610 —
Hobbs	32 40.00	103 05.00 9610 —
Silver City	32 45.00	108 20.00 9610 —
Aztec	36 45.00	108 00.00 9610 —

NEW YORK

Buffalo	42 50.00	078 55.00 9960 44/59
Kings Point	40 50.00	073 45.00 9960 26/43
Long Beach	40 35.00	073 35.00 9960 26/43
Montauk	41 00.00	072 00.00 9960 26/43
Oswego	43 25.00	076 30.00 9960 16/28
Rochester	43 15.00	077 35.00 9960 45/59
Sag Harbor	41 00.00	072 15.00 9960 26/43
Stony Brook	41 00.00	073 10.00 9960 15/28

	<u>LAT</u>	<u>LON</u>	<u>GRI/TD's</u>
<u>NORTH CAROLINA</u>			
Elizabeth City	36 30.00	076 10.00	9960 27/40
Englehard	35 30.00	076 00.00	9960 27/40
Hatteras	35 15.00	075 45.00	9960 27/40
Hobacken	35 15.00	076 30.00	9960 27/40
Kitty Hawk	36 05.00	075 45.00	9960 27/40
Morehead City	34 45.00	076 40.00	9960 27/40
New Bern	35 10.00	077 00.00	9960 27/39
Washington	35 30.00	077 00.00	9960 27/40
Wilmington	34 15.00	078 00.00	9960 27/40
<u>NORTH DAKOTA</u>⁶			
Cavalier	48 50.00	097 35.00	8290 —
Lidgerwood	46 05.00	097 10.00	8290 —
Crosby	48 50.00	103 25.00	8290 —
Bowman	46 15.00	103 28.00	8290 —
<u>OHIO</u>			
Ashtabula	41 55.00	080 50.00	8970 30/50
Cleveland	41 30.00	081 45.00	8970 30/50
Sandusky	41 25.00	082 40.00	8970 31/50
Toledo	41 40.00	083 30.00	8970 31/50
<u>OKLAHOMA</u>²			
Miami	36 50.00	094 55.00	9610 —
Idabel	33 50.00	094 45.00	9610 —
Altus	34 38.00	099 20.00	9610 —
Woodward	36 25.00	099 25.00	9610 —
<u>OREGON</u>			
Astoria	46 10.00	123 50.00	9940 12/28
Coos Bay	43 20.00	124 20.00	9940 13/27
Lincoln City	44 55.00	124 00.00	9940 12/27
Port Orford	42 45.00	124 30.00	9940 13/27
Portland	45 35.00	122 40.00	9940 12/28
Tillamook	45 30.00	123 55.00	9940 12/28
<u>PENNSYLVANIA</u>			
Erie	42 10.00	080 05.00	9960 44/58
<u>RHODE ISLAND</u>			
Narragansett	41 25.00	071 25.00	9960 25/43
Newport	41 30.00	071 20.00	9960 25/44
Warwick	41 40.00	071 20.00	9960 25/44

	<u>LAT</u>	<u>LON</u>	<u>GRI/TD's</u>
<u>SOUTH CAROLINA</u>			
Charlestown	32 50.00	080 00.00	7980 45/60
Georgetown	33 20.00	079 20.00	7980 45/60
Hilton Head Is.	32 10.00	080 45.00	7980 45/61
Myrtle Beach	33 40.00	079 00.00	7980 45/59
<u>SOUTH DAKOTA</u>^{3,6}			
Webster	45 20.00	097 30.00	8970 15/46
Vermillion	42 45.00	096 58.00	8970 16/46
McLaughlin	45 45.00	100 45.00	8970 16/46
Hot Springs	43 28.00	103 30.00	8970 16/46
<u>TEXAS</u>			
Aransas Pass	27 50.00	097 10.00	7980 23/46*
Beaumont	30 00.00	094 10.00	7980 26/47*
Galveston	29 20.00	094 40.00	7980 25/46*
Port Isabel	26 00.00	097 15.00	7980 11/23
Port Mansfield	26 30.00	097 20.00	7980 11/23
*The 11 TD may be unusable near the coast.			
<u>TENNESSEE</u>			
Johnson City	36 25.00	082 25.00	8970 15/48
S. Cleveland	35 20.00	084 50.00	9960 40/55
Union City	36 25.00	089 05.00	7980 12/62
Memphis	35 20.00	090 00.00	8970 14/51
<u>UTAH</u>²			
Vernal	40 28.00	109 30.00	9610 —
Blanding	37 40.00	109 25.00	9610 —
Tremonton	41 40.00	112 10.00	9610 —
Cedar City	37 45.00	113 50.00	9610 —
<u>VERMONT</u>			
St. Albans	44 45.00	073 05.00	9960 14/27
Rutland	43 35.00	072 58.00	9960 14/27
<u>VIRGINIA</u>			
Burgess	37 50.00	076 15.00	9960 27/41
Cape Charles	37 15.00	076 00.00	9960 27/41
Hampton	37 00.00	076 15.00	9960 27/41
Virginia Beach	36 50.00	076 00.00	9960 27/41

	<u>LAT</u>	<u>LON</u>	<u>GRI/TD's</u>
<u>NORTH CAROLINA</u>			
Elizabeth City	36 30.00	076 10.00	9960 27/40
Englehard	35 30.00	076 00.00	9960 27/40
Hatteras	35 15.00	075 45.00	9960 27/40
Hobacken	35 15.00	076 30.00	9960 27/40
Kitty Hawk	36 05.00	075 45.00	9960 27/40
Morehead City	34 45.00	076 40.00	9960 27/40
New Bern	35 10.00	077 00.00	9960 27/39
Washington	35 30.00	077 00.00	9960 27/40
Wilmington	34 15.00	078 00.00	9960 27/40
<u>NORTH DAKOTA</u>⁶			
Cavalier	48 50.00	097 35.00	8290 —
Lidgerwood	46 05.00	097 10.00	8290 —
Crosby	48 50.00	103 25.00	8290 —
Bowman	46 15.00	103 28.00	8290 —
<u>OHIO</u>			
Ashtabula	41 55.00	080 50.00	8970 30/50
Cleveland	41 30.00	081 45.00	8970 30/50
Sandusky	41 25.00	082 40.00	8970 31/50
Toledo	41 40.00	083 30.00	8970 31/50
<u>OKLAHOMA</u>²			
Miami	36 50.00	094 55.00	9610 —
Idabel	33 50.00	094 45.00	9610 —
Altus	34 38.00	099 20.00	9610 —
Woodward	36 25.00	099 25.00	9610 —
<u>OREGON</u>			
Astoria	46 10.00	123 50.00	9940 12/28
Coos Bay	43 20.00	124 20.00	9940 13/27
Lincoln City	44 55.00	124 00.00	9940 12/27
Port Orford	42 45.00	124 30.00	9940 13/27
Portland	45 35.00	122 40.00	9940 12/28
Tillamook	45 30.00	123 55.00	9940 12/28
<u>PENNSYLVANIA</u>			
Erie	42 10.00	080 05.00	9960 44/58
<u>RHODE ISLAND</u>			
Narragansett	41 25.00	071 25.00	9960 25/43
Newport	41 30.00	071 20.00	9960 25/44
Warwick	41 40.00	071 20.00	9960 25/44

	<u>LAT</u>	<u>LON</u>	<u>GRI/TD's</u>
<u>SOUTH CAROLINA</u>			
Charlestown	32 50.00	080 00.00	7980 45/60
Georgetown	33 20.00	079 20.00	7980 45/60
Hilton Head Is.	32 10.00	080 45.00	7980 45/61
Myrtle Beach	33 40.00	079 00.00	7980 45/59
<u>SOUTH DAKOTA</u>^{3,6}			
Webster	45 20.00	097 30.00	8970 15/46
Vermillion	42 45.00	096 58.00	8970 16/46
McLaughlin	45 45.00	100 45.00	8970 16/46
Hot Springs	43 28.00	103 30.00	8970 16/46
<u>TEXAS</u>			
Aransas Pass	27 50.00	097 10.00	7980 23/46*
Beaumont	30 00.00	094 10.00	7980 26/47*
Galveston	29 20.00	094 40.00	7980 25/46*
Port Isabel	26 00.00	097 15.00	7980 11/23
Port Mansfield	26 30.00	097 20.00	7980 11/23
*The 11 TD may be unusable near the coast.			
<u>TENNESSEE</u>			
Johnson City	36 25.00	082 25.00	8970 15/48
S. Cleveland	35 20.00	084 50.00	9960 40/55
Union City	36 25.00	089 05.00	7980 12/62
Memphis	35 20.00	090 00.00	8970 14/51
<u>UTAH</u>²			
Vernal	40 28.00	109 30.00	9610 —
Blanding	37 40.00	109 25.00	9610 —
Tremonton	41 40.00	112 10.00	9610 —
Cedar City	37 45.00	113 50.00	9610 —
<u>VERMONT</u>			
St. Albans	44 45.00	073 05.00	9960 14/27
Rutland	43 35.00	072 58.00	9960 14/27
<u>VIRGINIA</u>			
Burgess	37 50.00	076 15.00	9960 27/41
Cape Charles	37 15.00	076 00.00	9960 27/41
Hampton	37 00.00	076 15.00	9960 27/41
Virginia Beach	36 50.00	076 00.00	9960 27/41

WASHINGTON

	LAT	LON	GRI/TD's
Anacortes	48 20.00	122 35.00	5990 28/42
Cape Flattery	48 20.00	124 40.00	5990 28/41
Everett	48 00.00	122 10.00	5990 28/41
La Push	47 50.00	124 25.00	5990 28/41
Oak Harbor	49 15.00	122 35.00	5990 28/42
Port Townsend	48 05.00	122 45.00	5990 28/42
Seattle	47 35.00	122 25.00	5990 28/42
Tacoma	47 15.00	122 35.00	5990 28/42

WEST VIRGINIA

	LAT	LON	GRI/TD's
Martinsburg	39 28.00	077 58.00	9960 41/57
Hinton	37 40.00	080 50.00	9960 41/57
Parkersburg	39 18.00	081 35.00	9960 41/57
Holden	37 45.00	082 05.00	9960 41/56

WISCONSIN

	LAT	LON	GRI/TD's
Green Bay	44 35.00	087 55.00	8970 32/48
Manitowoc	44 05.00	087 40.00	8970 32/48
Milwaukee	43 00.00	087 55.00	8970 33/49
Port Wing	46 50.00	091 30.00	8970 32/45
Sheboygan	43 45.00	087 45.00	8970 32/48
Sturgeon Bay	44 50.00	087 20.00	8970 32/48

WYOMING²

	LAT	LON	GRI/TD's
Gillette	44 20.00	105 28.00	9610 —
Laramie	41 20.00	105 35.00	9610 —
Cody	44 30.00	109 05.00	9610 —
Rock Springs	41 30.00	109 10.00	9610 —

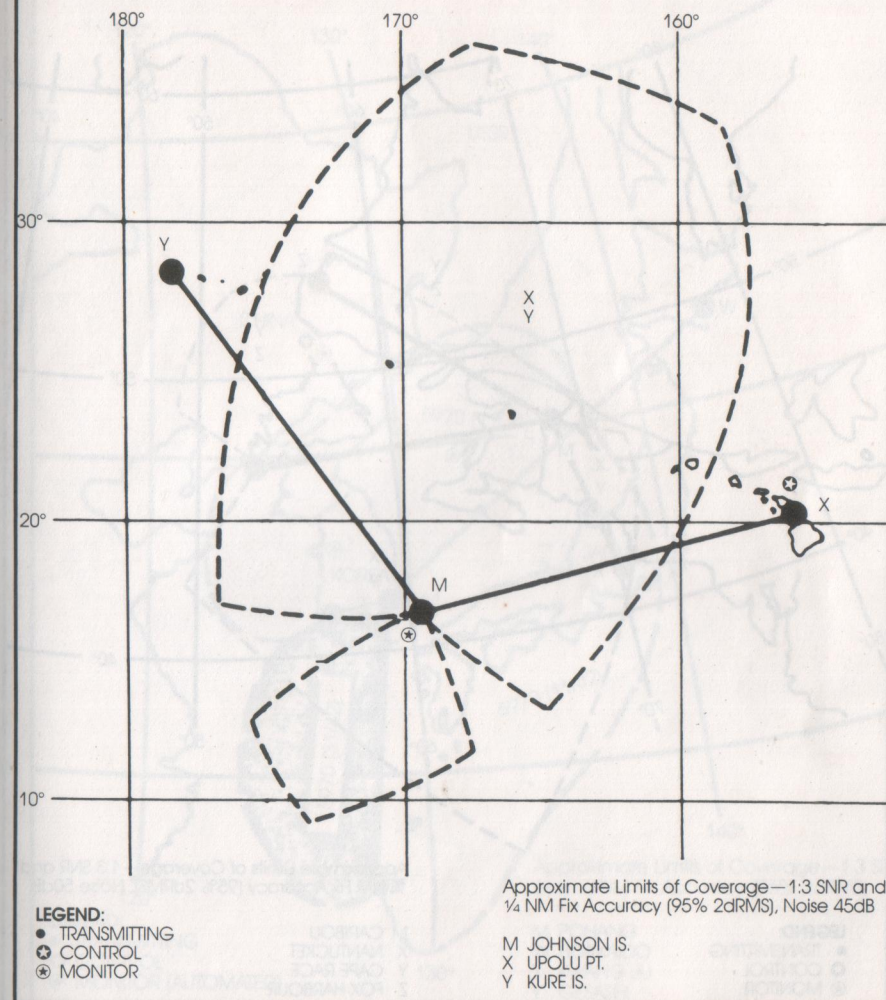
Note:

To convert any LAT/LON to TD's, enter LAT/LON in a WPT ___ and perform a FN28 using that waypoint. (See "NOTE" page 41)

1. The 7960 and 9990 chains are usable in other parts of the state.
2. The 9610 (SOCUS) Loran-C chain is expected to be operational early 1991. TD's are not available at this time. 9940 is usable in some areas.
3. The 8970 Loran-C chain will be expanded in 1991 for greater coverage westward. It may be usable on the preferred GRI for this area.
4. It is uncertain at the time of this printing which GRI's will be recommended for this area. TD's are not available at this time.
5. Currently eastern Kansas receives 8970. However, GRI 9610 will be preferred. See Footnote 2.
6. The 8290 (NOCUS) Loran-C chain is expected to be operational by spring of 1991. It may be the preferred chain in this area. TD's are not available at this time.
7. Loran-C reception/coverage may improve when the 9610 chain is operational. (See Footnote 2.)

LORAN-C

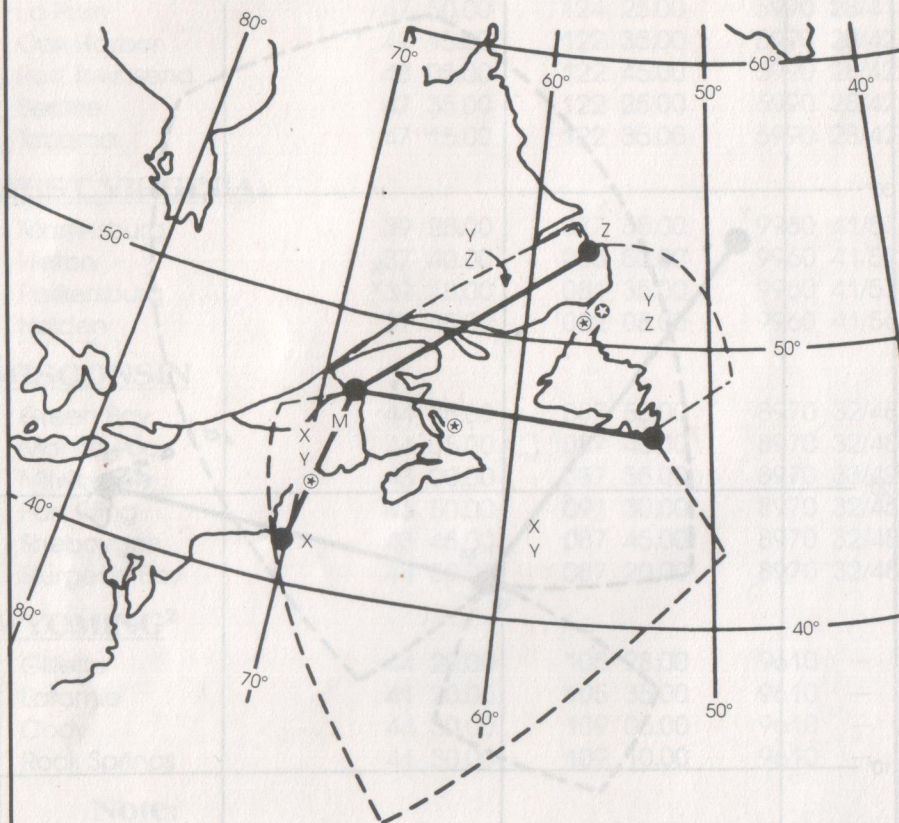
CENTRAL PACIFIC CHAIN GRI 4990



LORAN-C

CANADIAN EAST COAST CHAIN

GRI 5930



Approximate Limits of Coverage—1:3 SNR and
1/4 NM Fix Accuracy (95% 2dRMS), Noise 50dB

LEGEND:

- TRANSMITTING
- ★ CONTROL
- ⊙ MONITOR

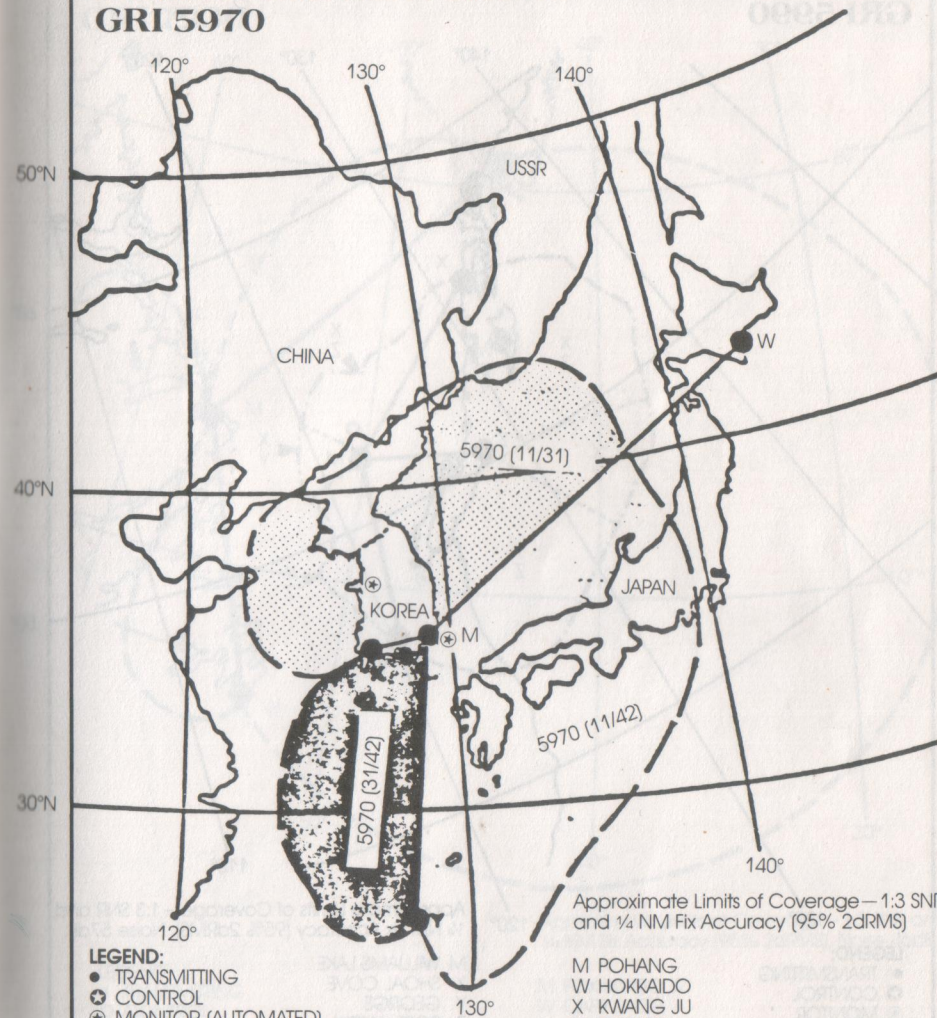
- M CARIBOU
- X NANTUCKET
- Y CAPE RACE
- Z FOX HARBOUR

LORAN-C

COMMANDO LION CHAIN

GRI 5970

	MIN. TIME DELAY	MAX. TIME DELAY
W:	11,000 usec	20,567.36 usec
X:	31,000 usec	32,894.04 usec
Y:	42,000 usec	49,131.12 usec



Approximate Limits of Coverage—1:3 SNR
and 1/4 NM Fix Accuracy (95% 2dRMS)

LEGEND:

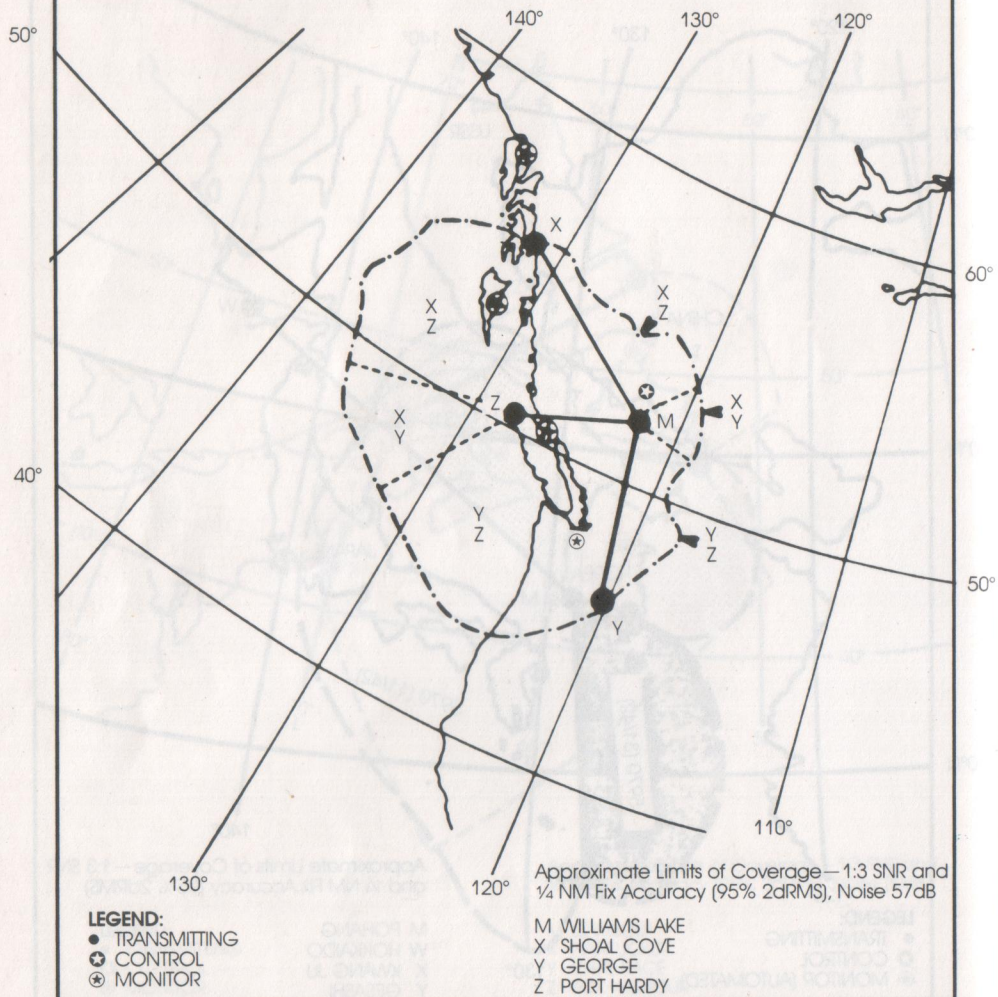
- TRANSMITTING
- ★ CONTROL
- ⊙ MONITOR (AUTOMATED)

- M POHANG
- W HOKKAIDO
- X KWANG JU
- Y GESASHI

LORAN-C

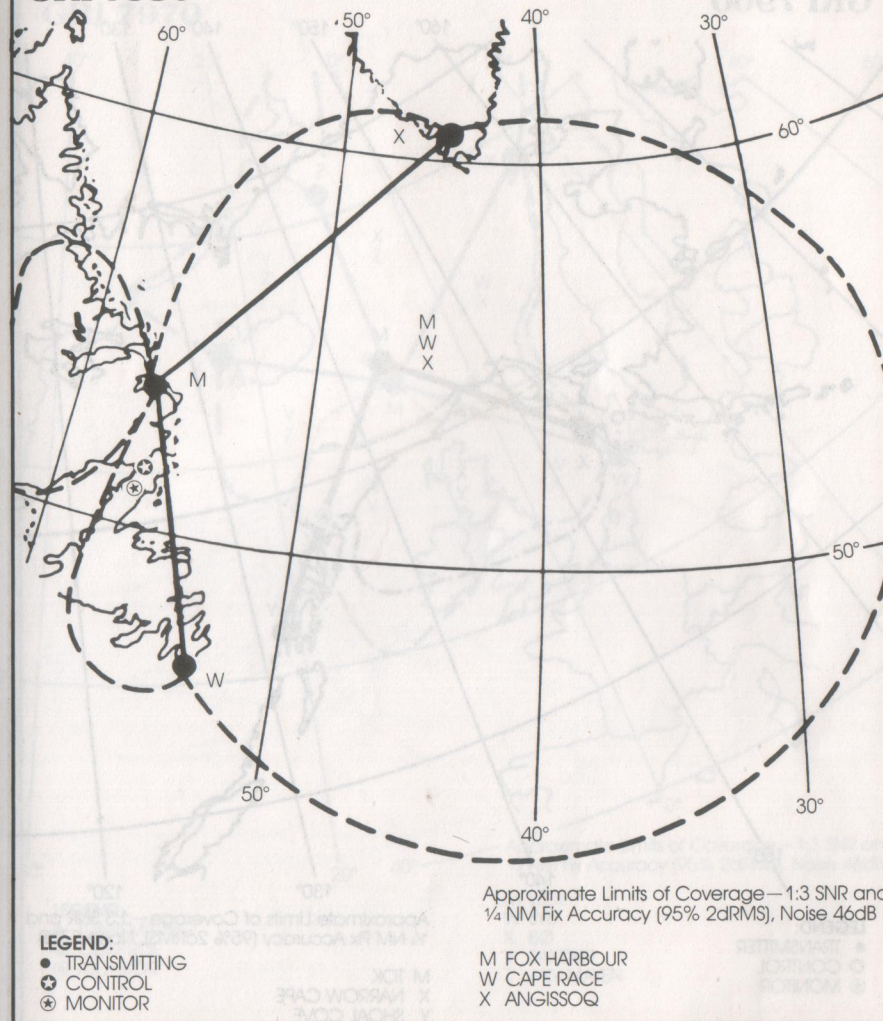
CANADIAN WEST COAST CHAIN GRI 5990

This diagram reflects
observed data.



LORAN-C

LABRADOR SEA CHAIN GRI 7930

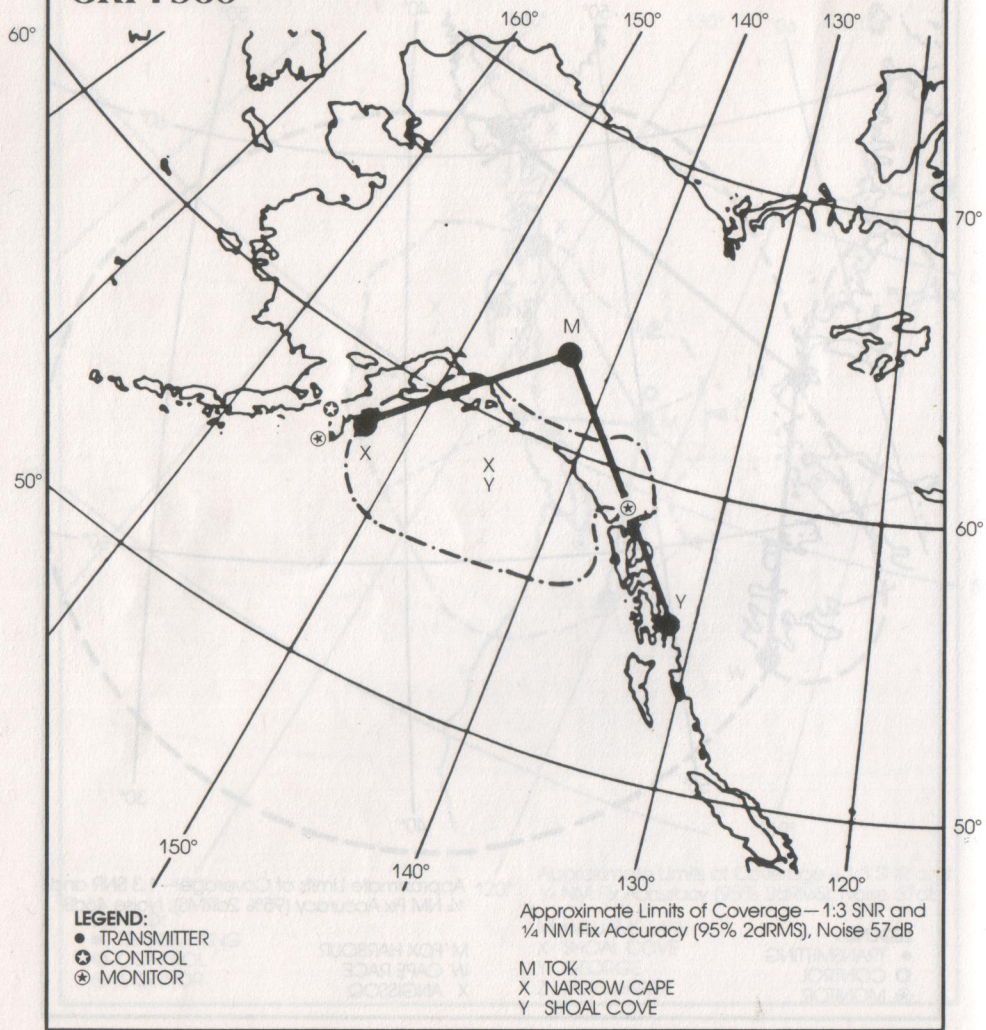


LORAN-C

GULF OF ALASKA CHAIN

GRI 7960

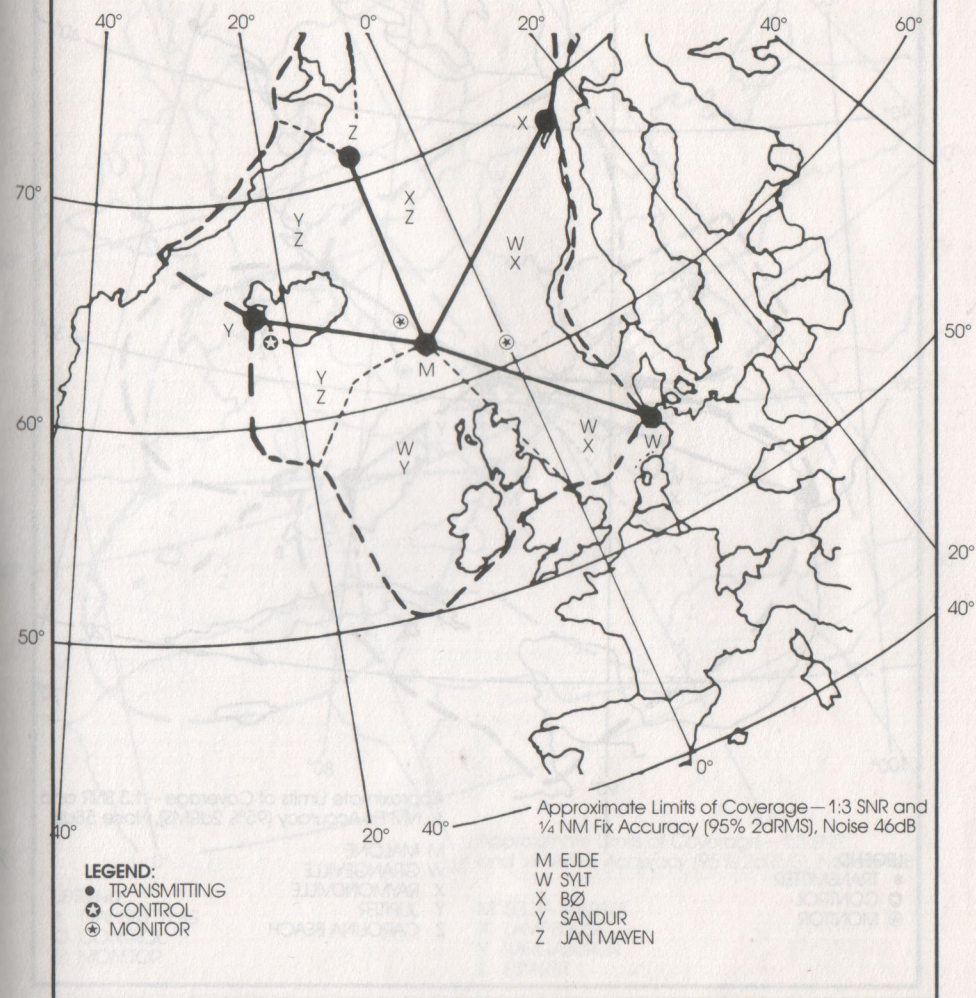
This diagram reflects
observed data.



LORAN-C

NORWEGIAN SEA CHAIN

GRI 7970



LORAN-C **SOUTHEAST U.S. CHAIN** **GRI 7980**

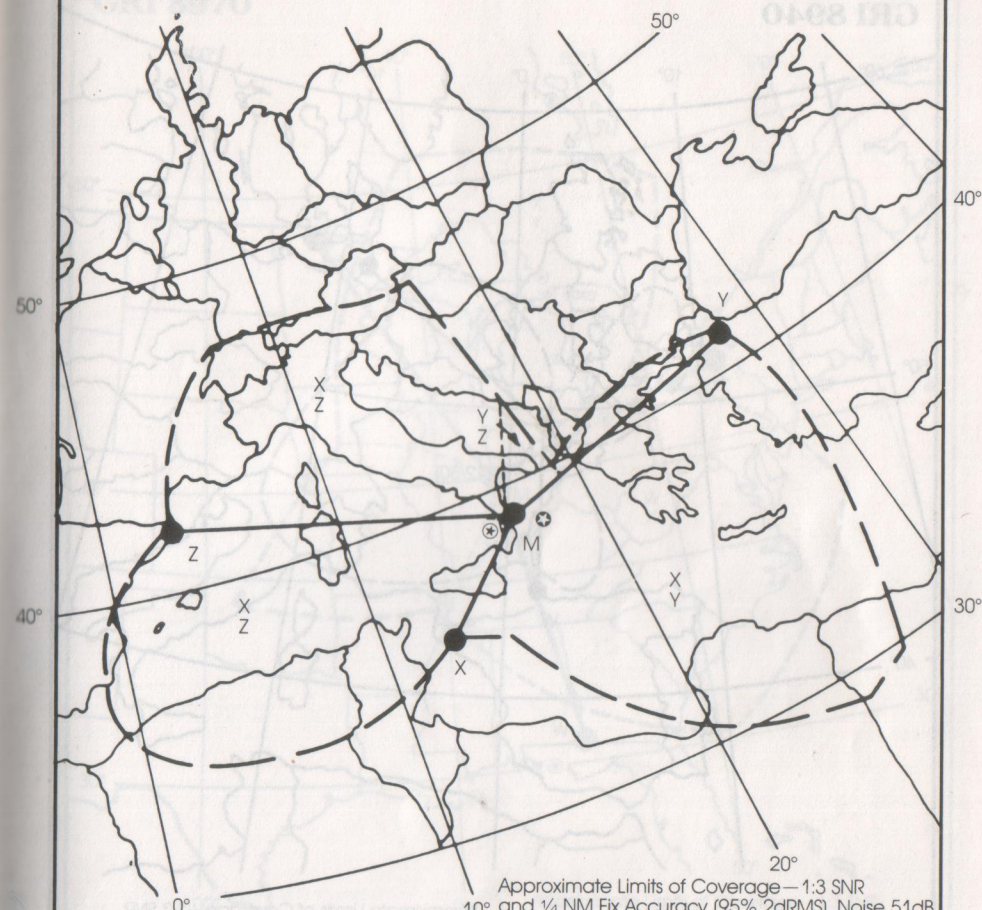


Approximate Limits of Coverage—1:3 SNR and
1/4 NM Fix Accuracy (95% 2dRMS), Noise 58dB

LEGEND:
● TRANSMITTER
★ CONTROL
⊕ MONITOR

M MALONE
W GRANGEVILLE
X RAYMONDVILLE
Y JUPITER
Z CAROLINA BEACH

LORAN-C **MEDITERRANEAN CHAIN** **GRI 7990**



Approximate Limits of Coverage—1:3 SNR
10° and 1/4 NM Fix Accuracy (95% 2dRMS), Noise 51dB

LEGEND:
● TRANSMITTING
★ CONTROL
⊕ MONITOR

M SELLIA MARINA
X LAMPEDUSA
Y KARGABURUN
Z ESTARTIT

LORAN-C

FRENCH-SYLT EXPERIMENTAL CHAIN GRI 8940



Approximate Limits of Coverage—1:3 SNR
and 1/4 NM Fix Accuracy (95% 2dRMS), Noise 46dB

LEGEND:
● TRANSMITTING
⊙ CONTROL
⊕ MONITOR

M LESSAY
W SOUSTONS
X SYLT

LORAN-C

GREAT LAKES CHAIN GRI 8970



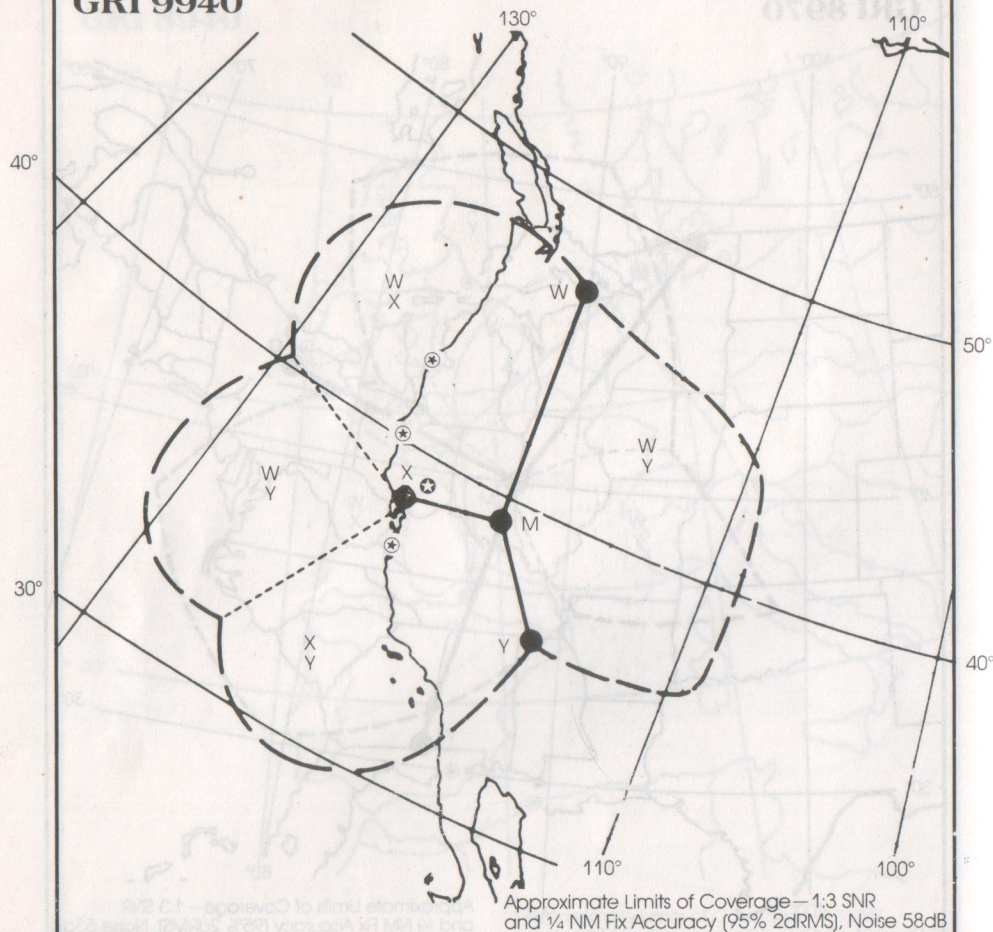
Approximate Limits of Coverage—1:3 SNR
and 1/4 NM Fix Accuracy (95% 2dRMS), Noise 53dB

LEGEND:
● TRANSMITTER
⊙ CONTROL
⊕ MONITOR

M DANA
W MALONE
X SENECA
Y BAUDETTE

LORAN-C

U.S. WEST COAST CHAIN GRI 9940

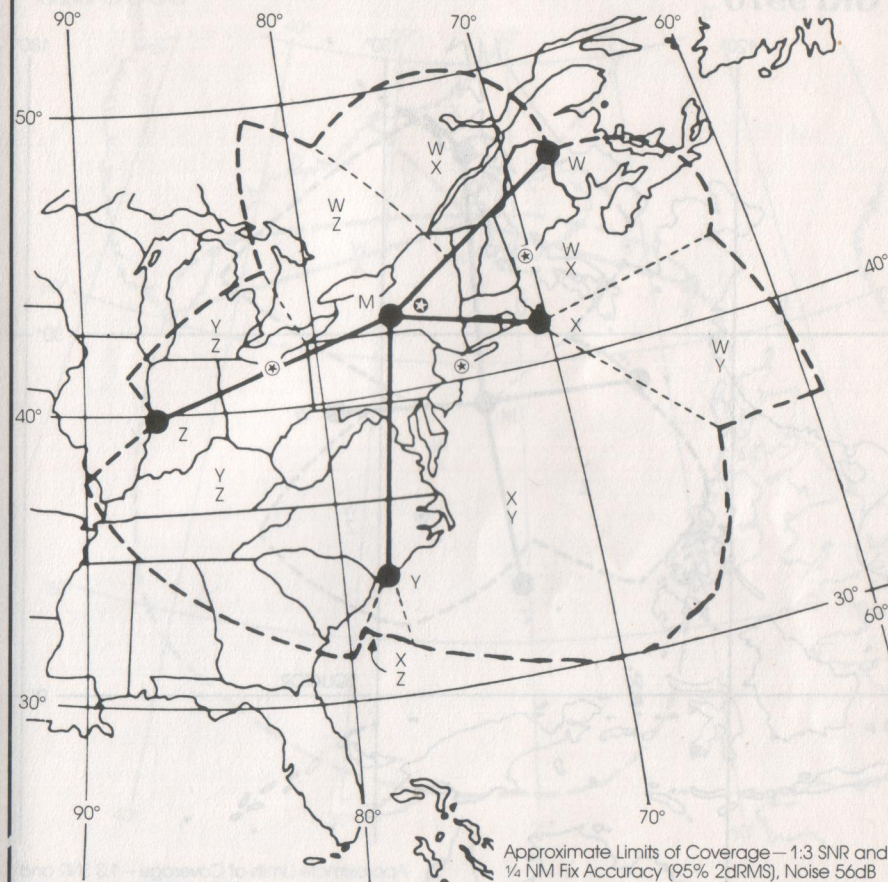


LEGEND:
● TRANSMITTER
★ CONTROL
⊙ MONITOR

M FALLON
W GEORGE
X MIDDLETOWN
Y SEARCHLIGHT

LORAN-C

NORTHEAST U.S. CHAIN GRI 9960



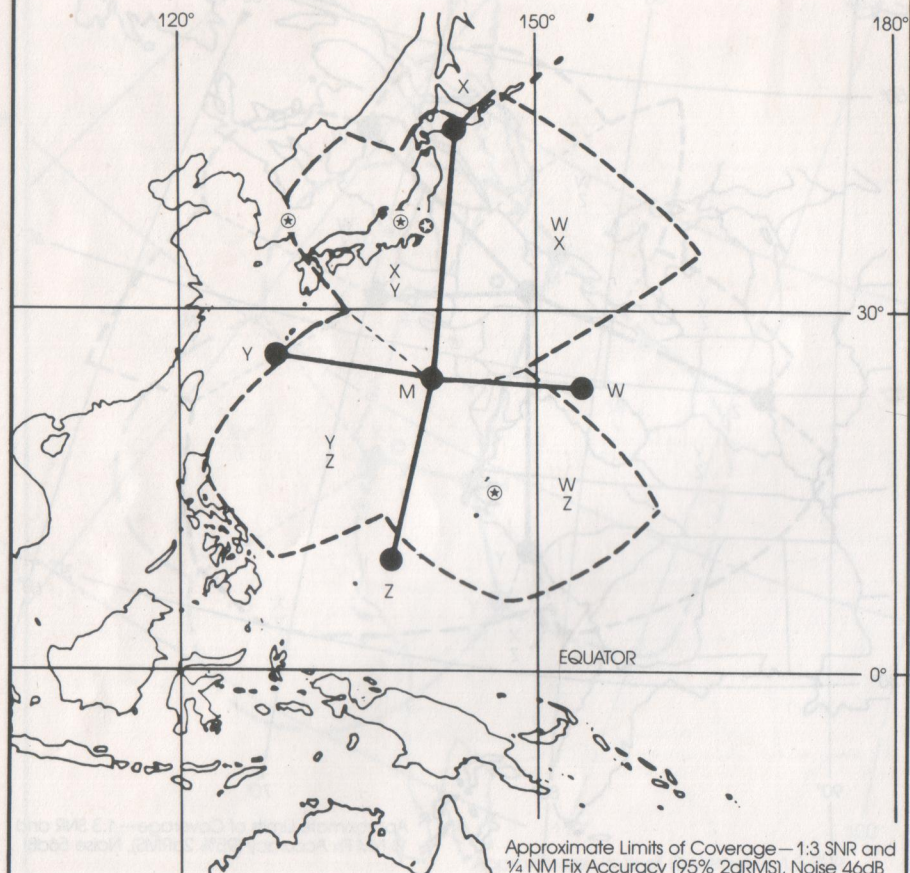
LEGEND:
● TRANSMITTING
★ CONTROL
⊙ MONITOR

M SENECA
W CARIBOU
X NANTUCKET
Y CAROLINA BEACH
Z DANA

LORAN-C

NORTHWEST PACIFIC CHAIN

GRI 9970



Approximate Limits of Coverage—1:3 SNR and
1/4 NM Fix Accuracy (95% 2dRMS), Noise 46dB

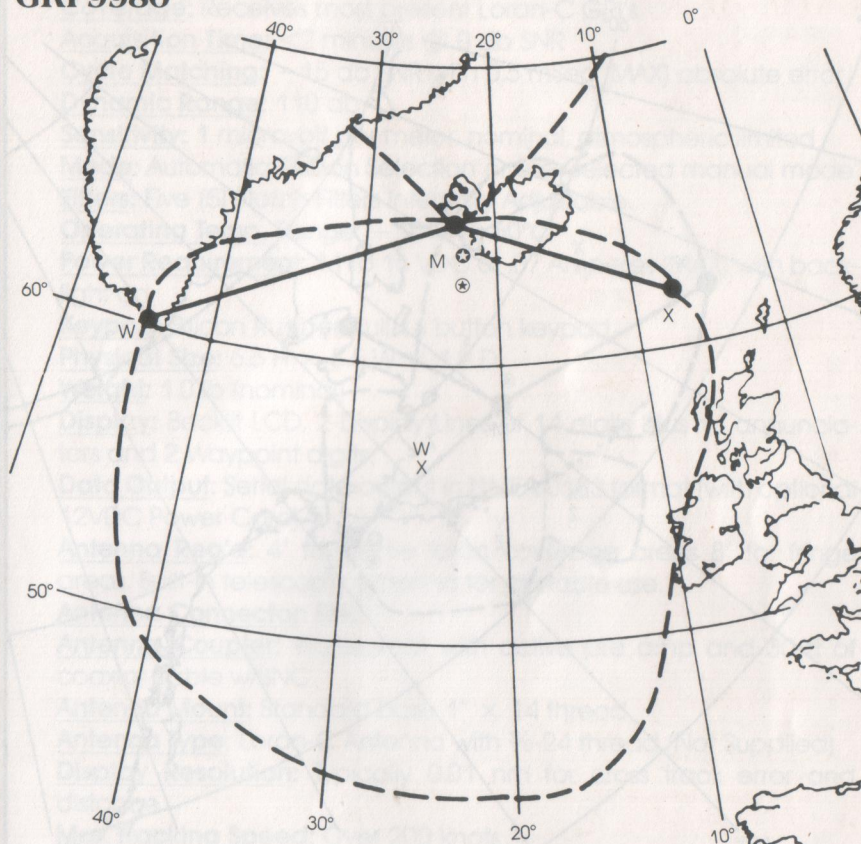
LEGEND:
● TRANSMITTING
★ CONTROL
⊕ MONITOR

M IWO JIMA
W MARCUS IS.
X HOKKAIDO
Y GESASHI
Z YAP IS.

LORAN-C

ICELANDIC CHAIN

GRI 9980

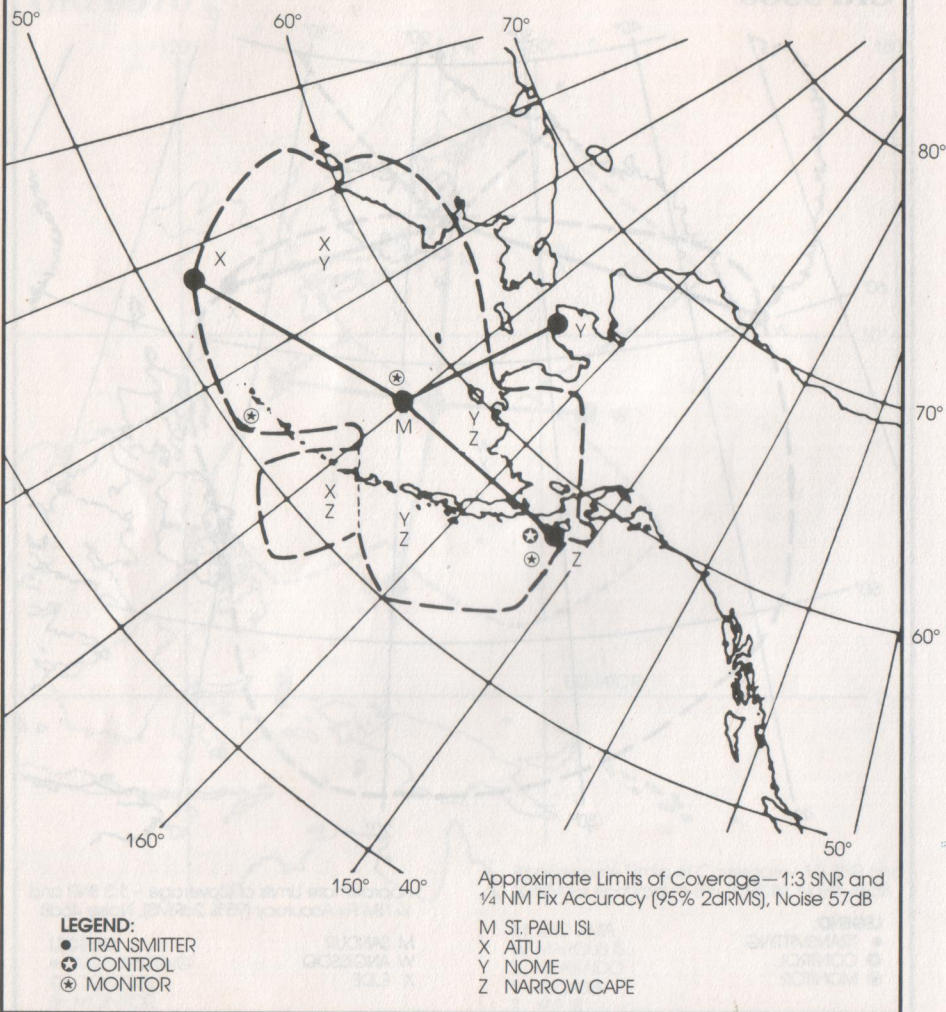


Approximate Limits of Coverage—1:3 SNR and
1/4 NM Fix Accuracy (95% 2dRMS), Noise 46dB

LEGEND:
● TRANSMITTING
★ CONTROL
⊕ MONITOR

M SANDUR
W ANGISSOK
X EJDE

LORAN-C NORTH PACIFIC CHAIN GRI 9990



SPECIFICATIONS

MODEL PL-99 AUTOMATIC LORAN-C

Coverage: Receives most present Loran-C GRI's

Acquisition Time: <2 minutes @ 0 db SNR

Cycle Matching: — 15 db SNR with 0.5 mSec (MAX) absolute error

Dynamic Range: 110 db

Sensitivity: 1 microvolt per meter, nominal, atmospheric limited

Mode: Automatic Station Selection or user selected manual mode

Filters: Five (5) Notch Filters Internally Adjustable.

Operating Temp. Range: — 10°C to 60°C

Power Requirement: 11 to 16 VDC at .07 Amperes (MAX) with back-light on

Keypad: Silicon Rubber, Full 14 button keypad

Physical Size: 6.5 H × 3.5 W × 1.9 D

Weight: 1.0 lb (nominal)

Display: Backlit LCD, 2-Display Lines of 14 digits plus 16 annunciators and 2 Waypoint digits

Data Output: Serial data output in NMEA/0183 format (with optional 12VDC Power Cord)

Antenna Req'd: 4' for prime loran coverage areas 8' for fringe areas. Built-in telescopic antenna for portable use.

Antenna Connector: BNC

Antenna Coupler: Waterproof with active pre amp and 30 ft of coaxial cable w/BNC

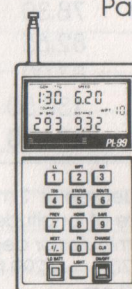
Antenna Mount: Standard base 1" × 14 thread

Antenna Type: Loran-C Antenna with 3/8-24 thread (Not Supplied)

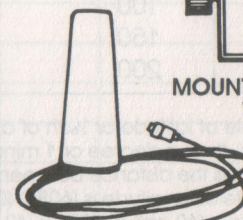
Display Resolution: Typically 0.01 nm for cross track error and distance

Max Tracking Speed: Over 200 knots

Options: AP-1 Accessory Package contains; Antenna Coupler, 12VDC Power Cord, Trunnion and Thumb Screws. CB-1 Padded Carrying Case for PL-90 and Accessories.



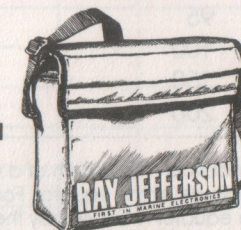
RECEIVER



ANTENNA COUPLER
W/30 FT. CABLE



MOUNTING TRUNNION
W/KNOBS



CARRY CASE

Nautical* Miles (6080 Ft.)	TO	Statute Miles (5280 Ft.)	Statute Miles (5280 Ft.)	TO	Nautical* Miles (6080 Ft.)
1		1.15	1		0.87
2		2.30	2		1.74
3		3.45	3		2.61
4		4.60	4		3.48
5		5.75	5		4.35
6		6.90	6		5.22
7		8.05	7		6.09
8		9.20	8		6.96
9		10.35	9		7.83
10		11.50	10		8.70
15		17.25	15		13.05
20		23.00	20		17.40
25		28.75	25		21.75
30		34.50	30		26.10
35		40.30	35		30.45
40		46.00	40		34.80
45		51.75	45		39.15
50		57.50	50		43.50
55		63.25	55		47.85
60		69.00	60		52.20
65		74.75	65		56.55
70		80.5	70		60.90
75		86.25	75		65.25
80		92.00	80		69.60
85		97.75	85		73.95
90		103.50	90		78.30
95		109.25	95		82.65
100		115.00	100		87.00
150		172.50	150		130.50
200		230.00	200		174.00

104

[illegible]

PL-99 LORAN LOG

[illegible]